



Featured: shape white do it (/id/shape-white-do-it/)

Laser Cutting (/tag/type-id/category-workshop/channel-laser-cutting/)

(/)

Life Hacks (/tag/type-id/category-home/channel-life-hacks/)

Fusion 360 (/id/Fusion/)



About This Instructable

846,891 views

227 favorites

Posted:
Mar 10, 2006

License:



kd7vnn
(/member/kd7vnn/)

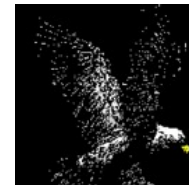
Follow

16

(/member/kd7vnn/)

Bio: I'm just this guy you know?!

More by kd7vnn:



(/id/How-to-make-a-

custom-library-part-in-Eagle-CAD-too/)

Tags:

project of the month (/tag/type-id/keyword-project%20of%20the%20mc

circuit design (/tag/type-id/keyword-circuit%20design/)

CAD (/tag/type-id/keyword-CAD/)

circuit layout (/tag/type-id/keyword-circuit%20layout/)

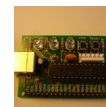
Eagle (/tag/type-id/keyword-Eagle/)

thosethingsoneforgets (/tag/type-id/keyword-thosethingsoneforgets/)

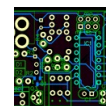
Add instructable to:

Group

Related



Making Printed circuit Boards at or Near Home: A Comprehensive Overview, Almost a Gui... (/id/Making-



Choosing PCB Layout Software (/id/Choosing-PCB-Layout-Software/) by ProvideYourOwn



Toner Transfer Method and Sticker Method of PCB fabrication along with EAGLE tutorial (/id/Etching-Method-



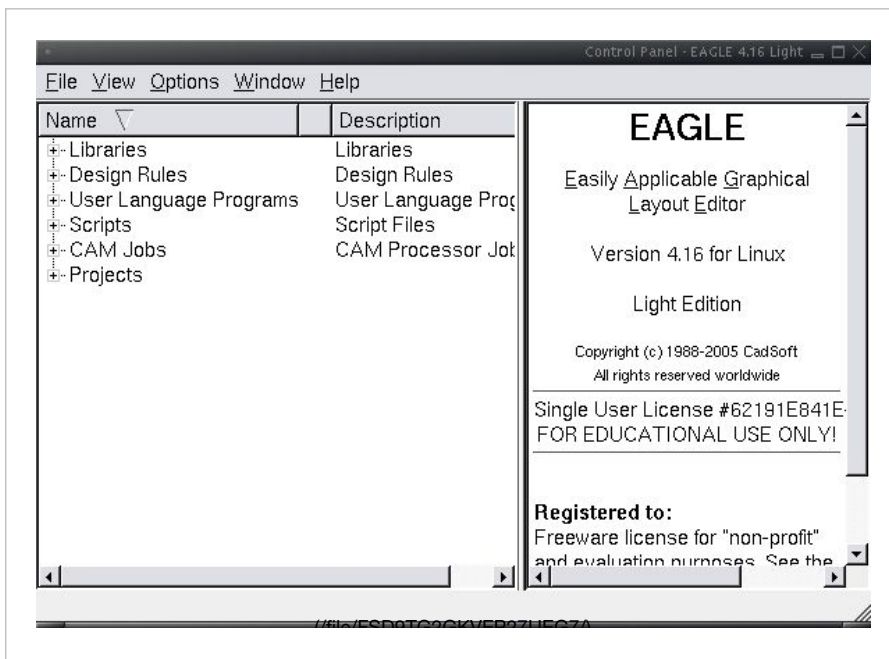
Compact Circuit Boards with Eagle ... No Etching! (/id/Compact-Circuit-Boards-with-Eagle-No-Etching/)

Simple Home Made PCB layout Using 'eagle software' (/id/Simple-Home-Made-

The eagle cad tool is a great thing. It does have something that I see as a draw back. That is that you need to pick a package for your part while you are still working on the schematic phase of a project. I assume Cadsoft (<http://www.cadsoft.de/>), the makers of eagle, have their reasons. Although eagle comes with an extensive part library, some times the part you want is not in the package you want, and other times neither the package or part you want is in their libraries. In these cases you are you are left with two choices. First,

pick a similar part that already exists. Second, make your own part. This instructable will focus on the later option.

Step 1: Start the Eagle control panel



That step should be self explanatory.

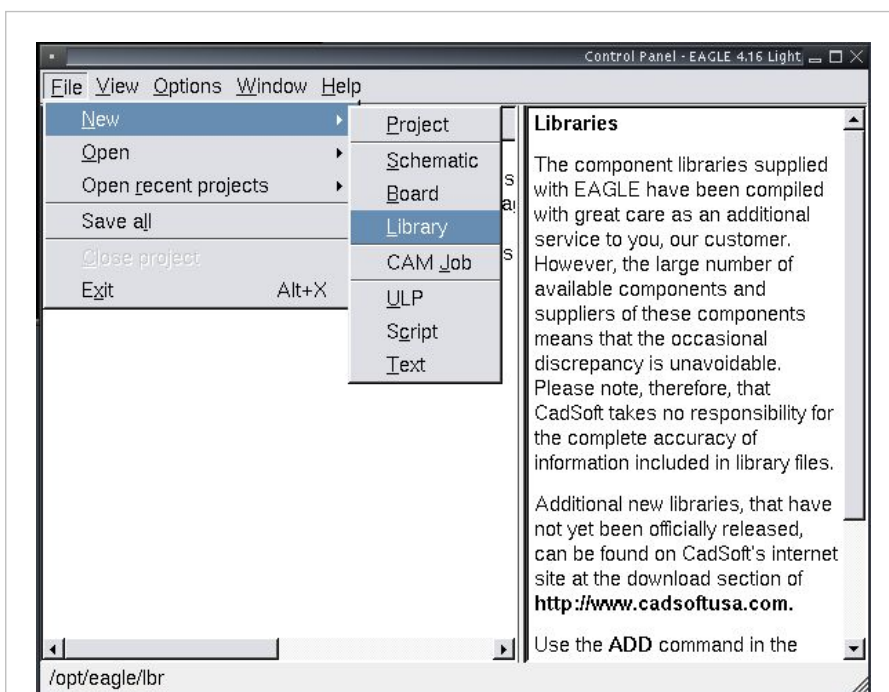
In linux type eagle from the command line.

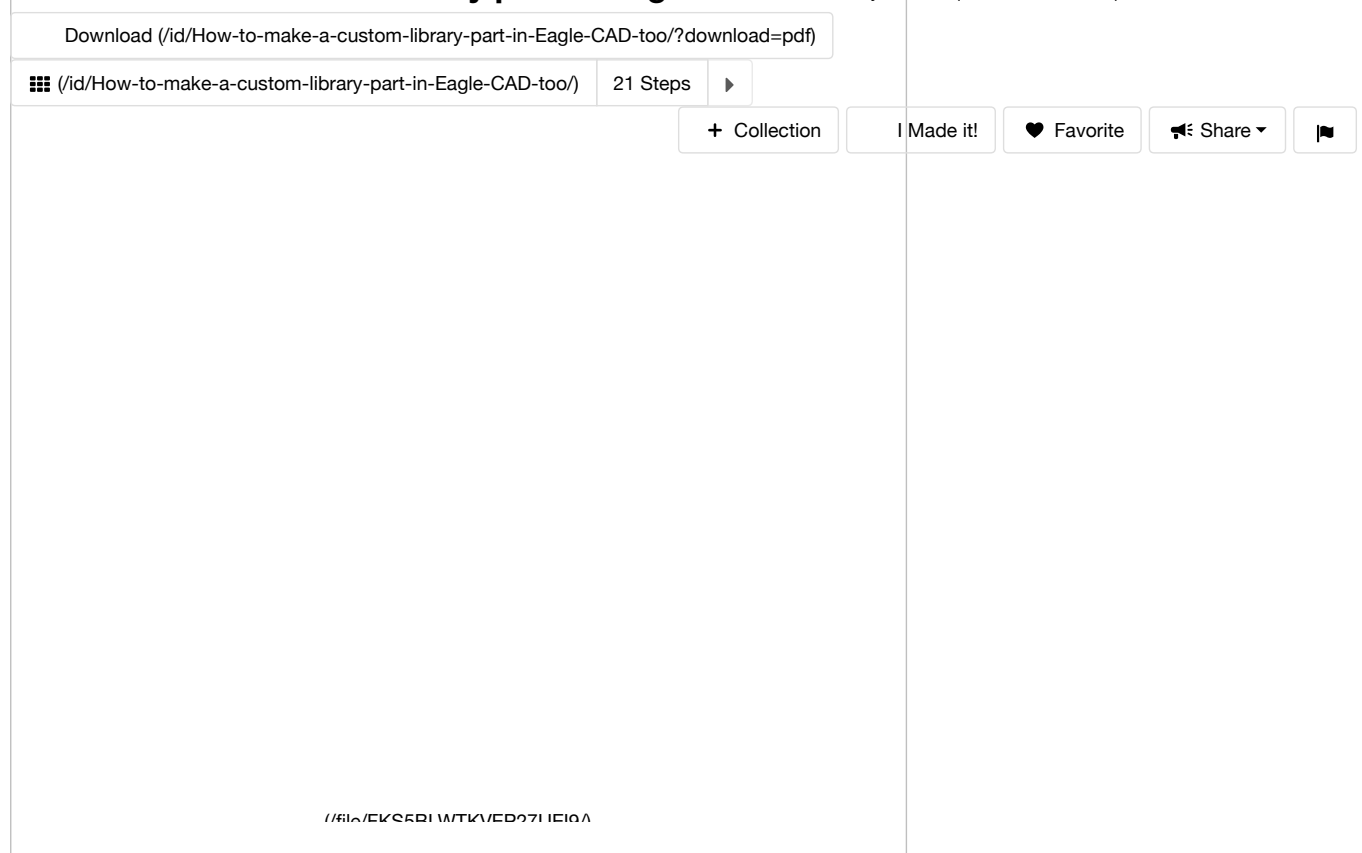
In windows double click on the eagle icon.

Or start->programs->eagle layout editor (version) -> eagle

Your screen should look something like this now.

Step 2: Select or create a library



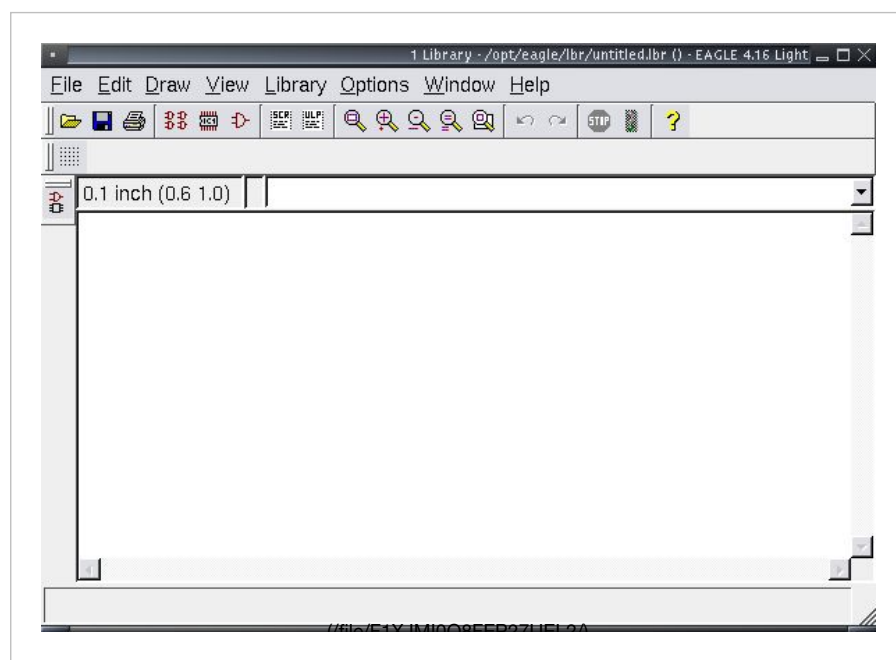


Decide where you want your new part to be. I suggest creating your own library. If you have your own library it will be easier to share your work with others.

1) To create a new library go to the menu bar and select File->New->Library

2) Add to existing library in the left pane of the control panel right click on the library you want to add the part to and select open.

Step 3: The new library

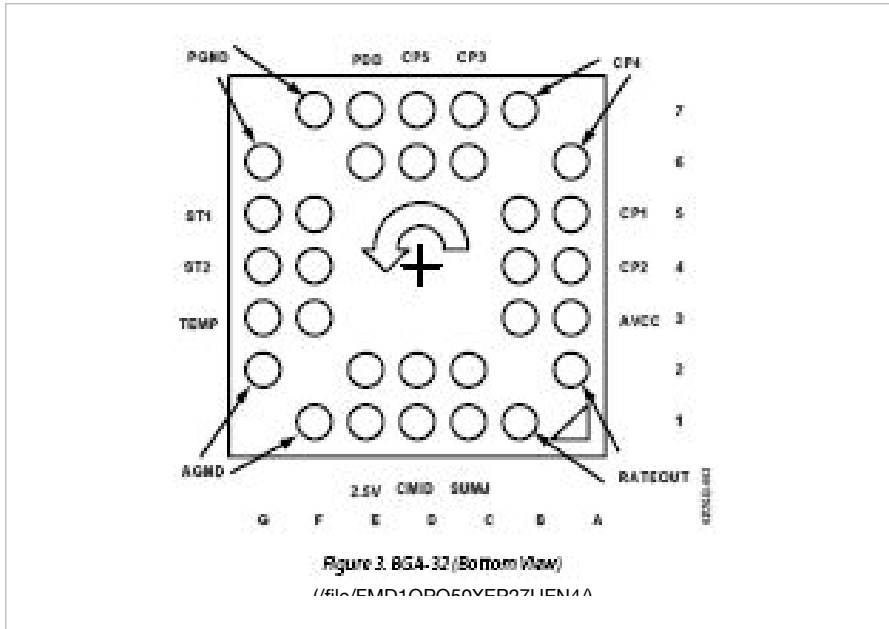


Your screen should look like this. From here on out I will assume that you created a new library, but this really doesn't matter.

Step 4: The easy way or the hard way.

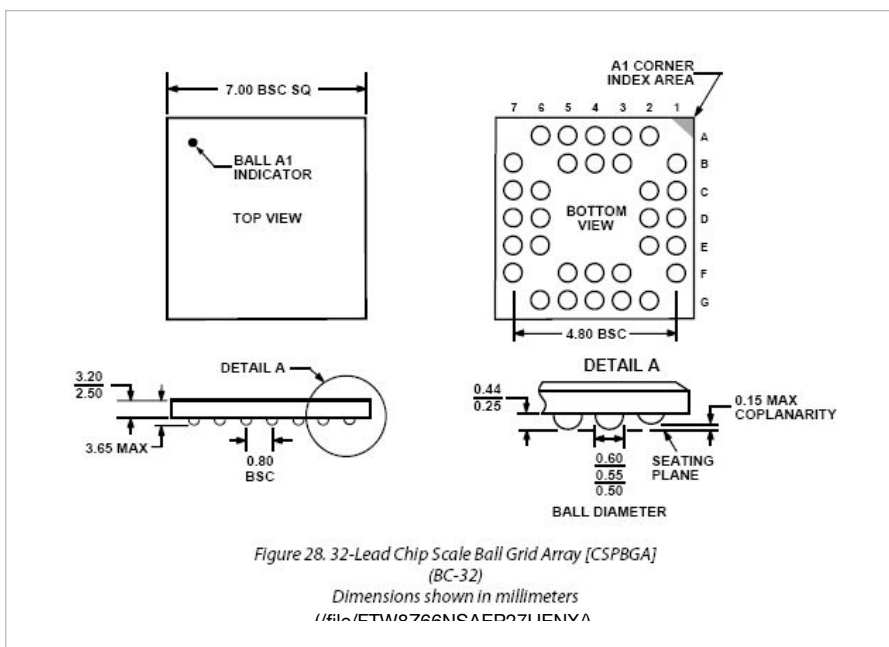
To design a part in eagle you must define a device, package, and symbol. Each aspect has its own set of layers that you must keep straight. Again you are left with two choices. The easy way, in which you copy a similar part and tweak it to match your specifications. This is of course in contrast to making one from scratch. For this instructable we will design one from scratch.

Step 5: Time to get out the data sheet.



For this instructable we will design a part used in the IMU for the PSAS (<http://psas.pdx.edu>) rocket. The object of our affection is the ADXRS150 gyroscope from Analog Devices (<http://www.analog.com>). To get all the parameters we need for the design we need not look any further then our trusty data sheet (http://www.analog.com/UploadedFiles/Data_Sheets/778386516ADXRS150_B.pdf).

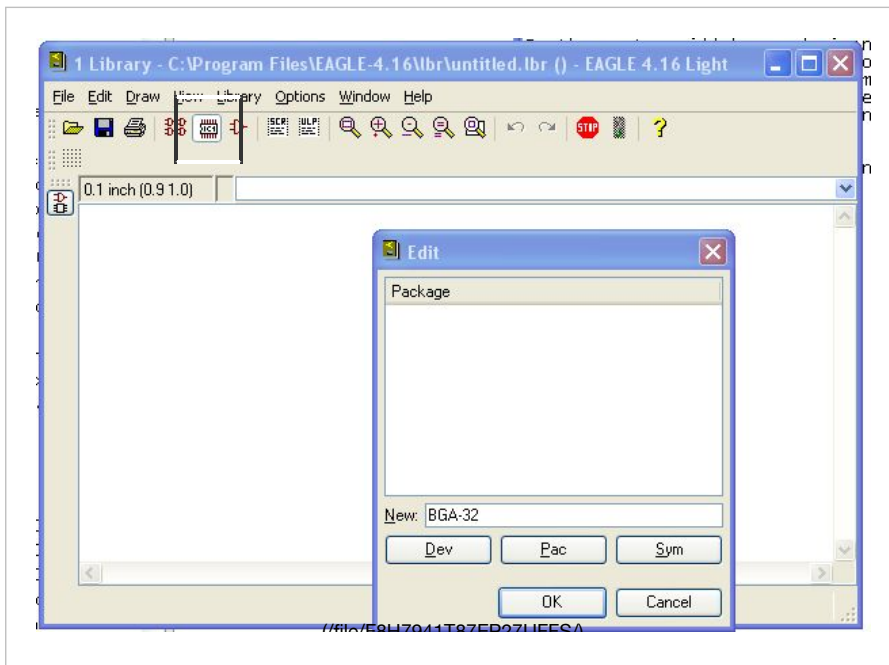
Step 6: The Package



As I mentioned there are three aspects to a part in eagle. We will start with the

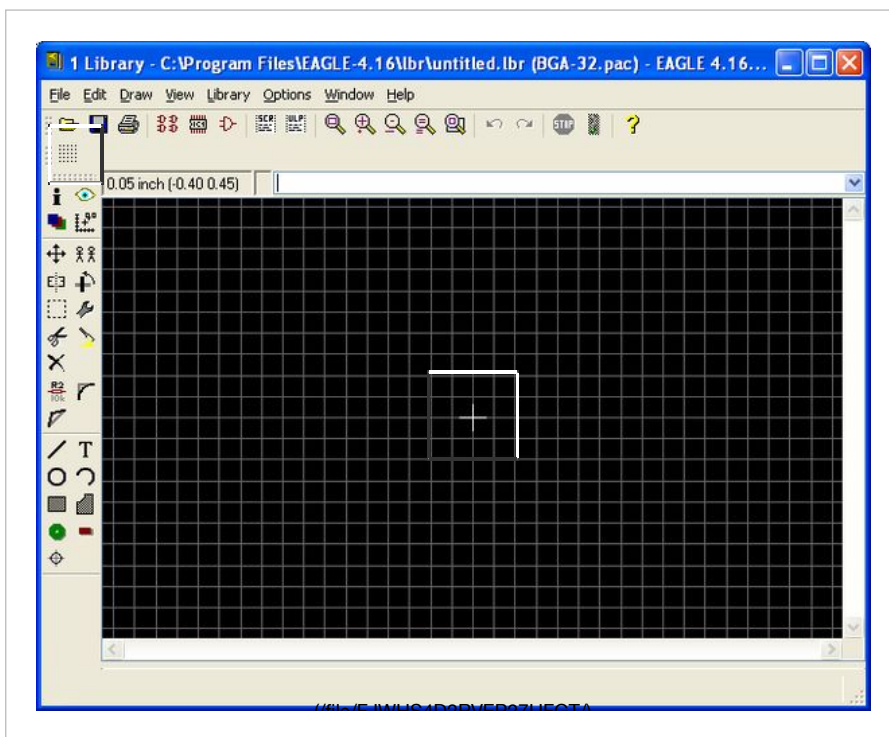
package. We want to make a 32 lead BGA (Ball Grid Array). From the data sheet we can see that the balls are 0.55mm in diameter, and spaced 0.80mm on center apart. The far edges are 4.80mm apart on center.

Step 7: Building the package



click on the package icon in your library window. The edit box will pop up and in the "new" field type BGA-32 (remember we are making a 32 lead Ball Grid Array). and hit ok. You will get a warning asking "Create new package'BGA-32', click "yes".

Step 8: Setting the Grid

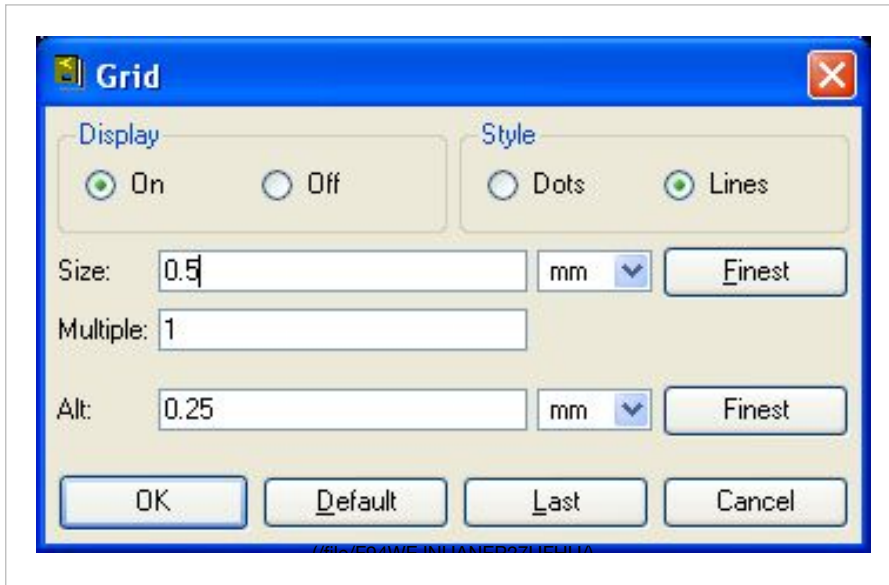


The default eagle setup will create a black screen with a grid on it. In the center will be a dominant white cross. This cross is the center of our package. It will be the point by which people will select/move the package

around.

Placing our pads and other parameters wisely around this cross is important. From the previous set we know we need some fine resolution make the grid half of what our smallest component is.

Step 9: Setting the grid (cont)



Recall the data sheet has balls that are .55mm in diameter and are spaced .8mm apart on center.

The centers of the balls on parallel outer edges are 4.8 mm apart on center. So we want a

grid size that will make it easy for us to place these balls.

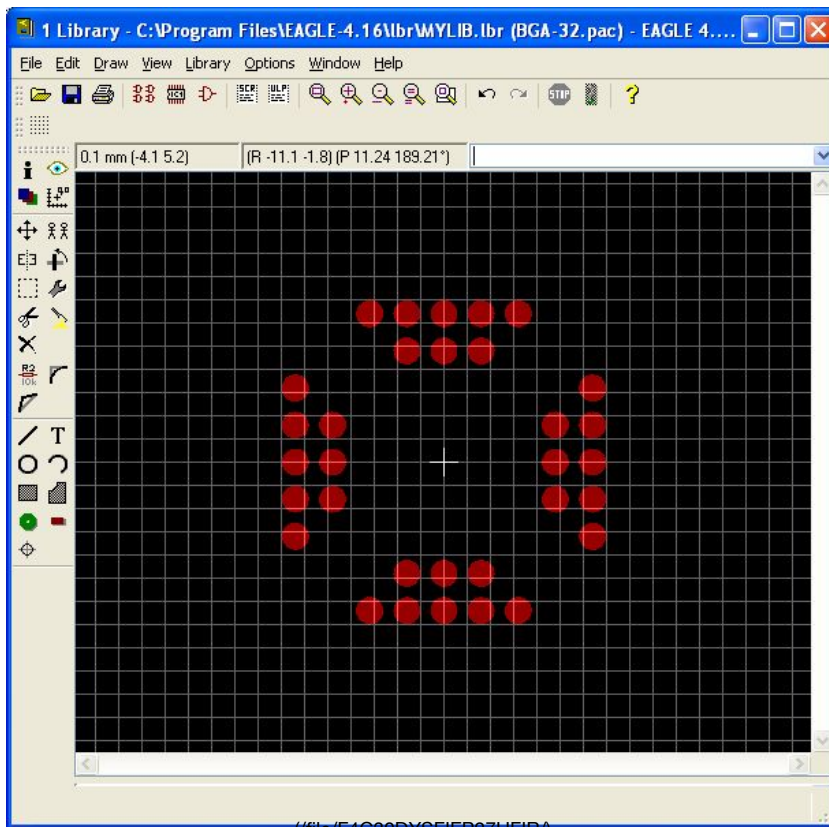
From the "view" menu select grid, or simply type grid into the command window.

The grid tool will open up make the size 0.2 units mm Alt: 0.2 and multiple of 5. Without

the multiple the grids are too small to be displayed. Note the lines will now be 1 mm apart. leave the display on

and the style lines. Your screen will have a dizzying amount of grid lines on it.

Step 10: Adding Pads

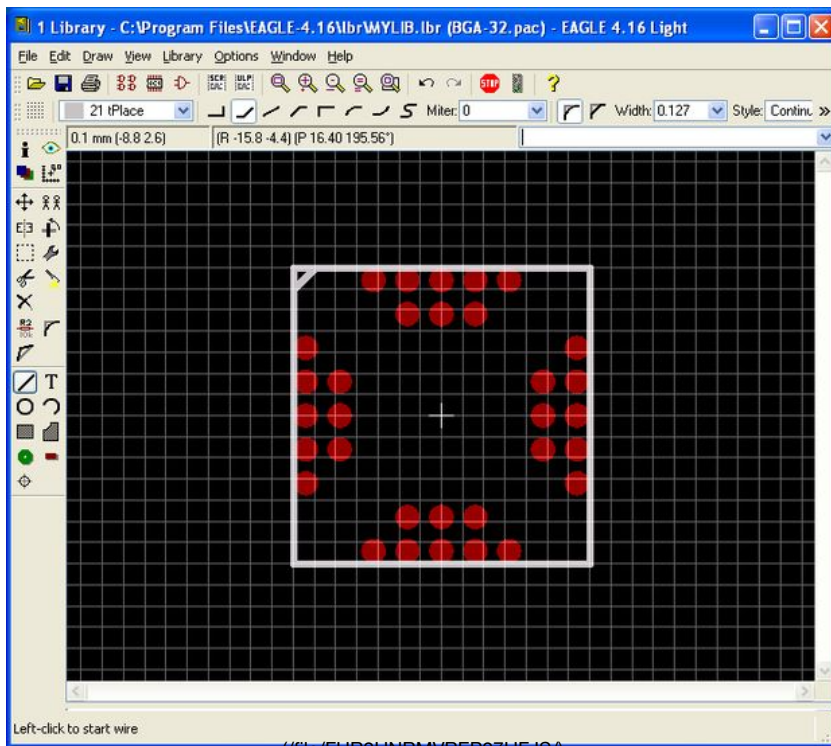


At this point if you want to copy another package from an alternate library you can use the copy command with the following syntax in the command window.
`copy packagename@libraryname`
 and the package will magically appear, but being man a first principles I'll show you the long way.

As mentioned earlier one must be careful to make sure one adds elements to the appropriate layer. Our pads (i.e. balls) for example will belong to the top layer. In the command window type `smd`, this command will be used to create the pads. By default the top layer will be selected. In the Smd drop down box will not have a circle by default in that box type "0.55 x 0.55", and make the roundness 100%. I also placed a second crosshair as a reference guide 7mm up and 7mm over know that is the over all size of the chip. One measurement that is missing is how far from the edge are the pins. Being a slave to symmetry I made the assumption that the center of the ball would be .8 mm away from the edge. With properly spaced grids, using the mouse to place pads can be very quick accurate. Alternatively, in the command window if you can type (x-cord y-cord) and the pad will be placed where you want it. Place the pads as well as you can, and it should look like this when you are done.

Hints: It may be easier to make the origin the center of the device and just give the coordinates to place the pads (3.2 0) (-3.2 0) ... etc

Step 11: Details for a cleaner look



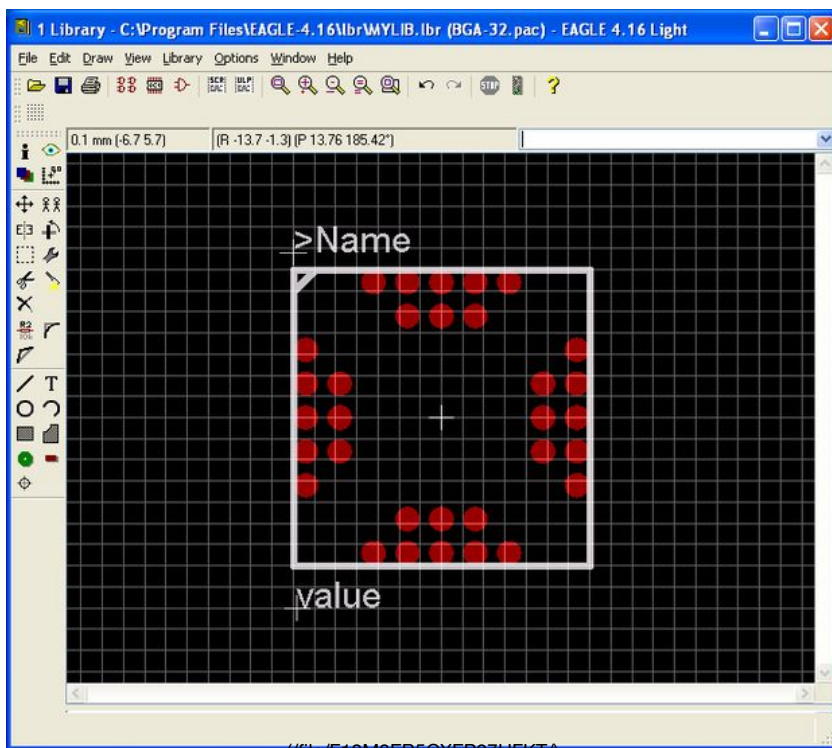
On the tPlace layer put an outline of the chip's foot print and make the Ball A1 indicator visible with the wire tool.

Type wire in the command window. Select 21 tPlace for the layer. Now draw a 7mm box around all the pads you placed in step 10. Either trace it out or type the coordinates in the command window.

Step 12: Name Pads

To make our life easy in the future its a good idea to name the pads. Type name in the comand window, and double click on each pad. A dialog box will appear and simply type in the new name. Its good to go off of what the data sheet uses for names as you will have to repeat this process for the symbol. Following this advice will make the final step (matching package with symbol) much easier, however, it does not make for a generic package (i.e. when you want to use this package for a different device).

Step 13: Add name and value



name and value parameters are added on separate layers tname and tvalue respectively.

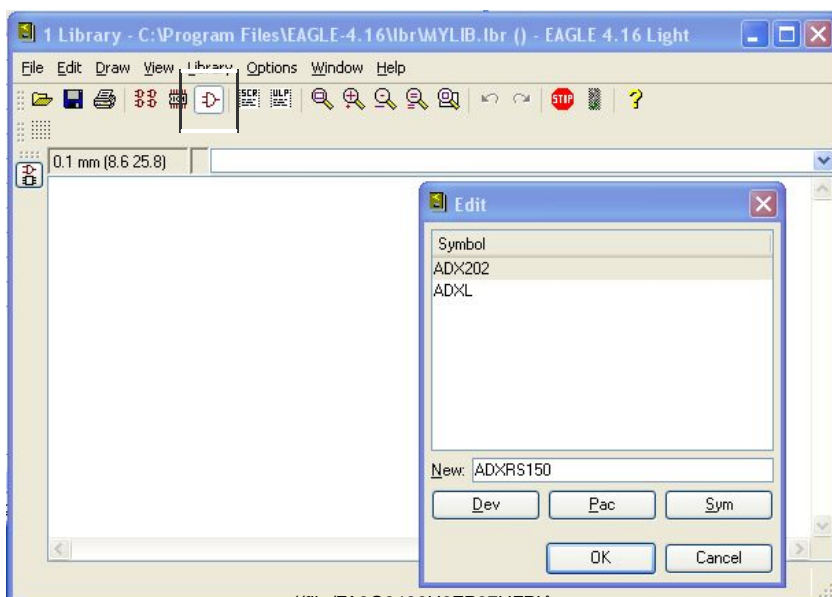
These will be named later on by who ever is using the package so just put in generic headings like "name" and "value"

Select the text tool or type text in the command window. Select the tName layer, and an appropriate size and place on the top of the drawing.

Repeat this process for the value but use the value layer.

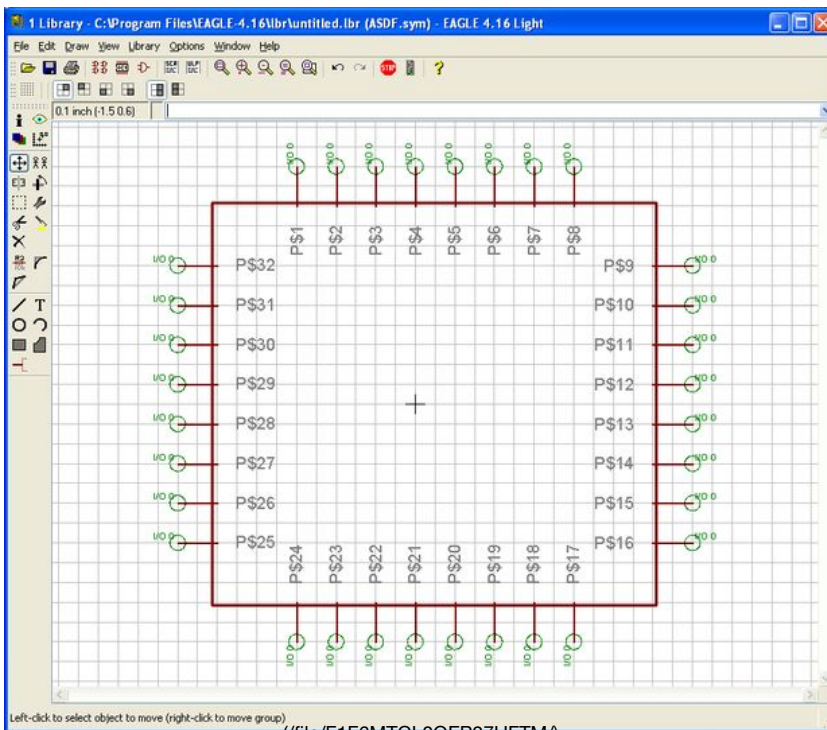
Test to make sure you have the right elements on the right layers by selecting the layer tool and turning off all the layers except the one you want to check.

Step 14: Building the Symbol



Step 15: Back to the data sheet

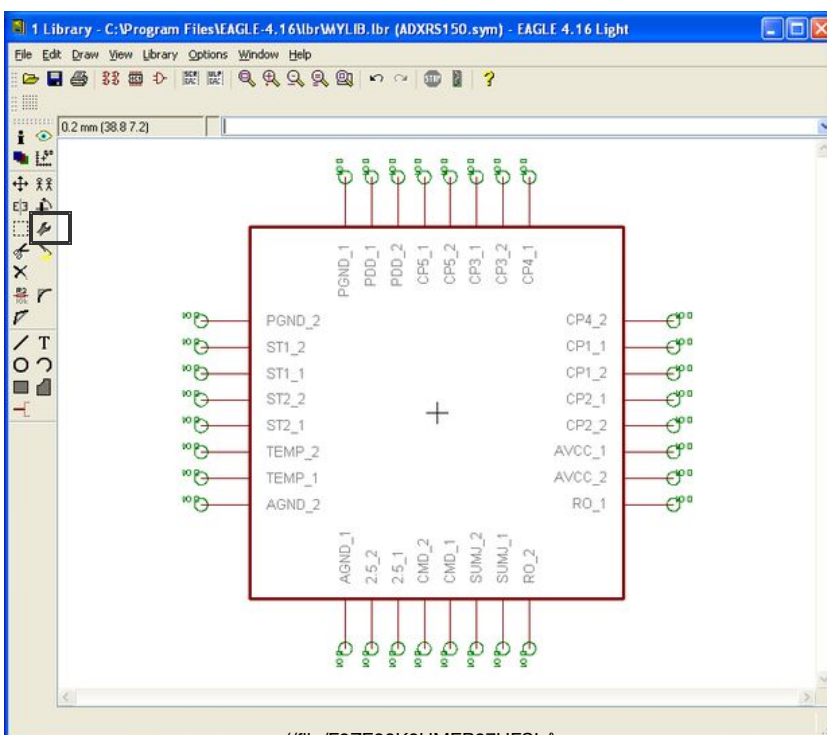
Step 16: Draw the symbol



Use the wire tool to draw a box that will represent the symbol on the schematic. By default you will be drawing on the symbol layer. Double check to make sure by looking in the upper left corner after the wire tool is selected. The layer drop down menu should have "94 Symbols" selected.

Once the box is drawn, type "pin" in the command window, and start placing the 32 pins evenly around the box.

Step 17: Naming Pins



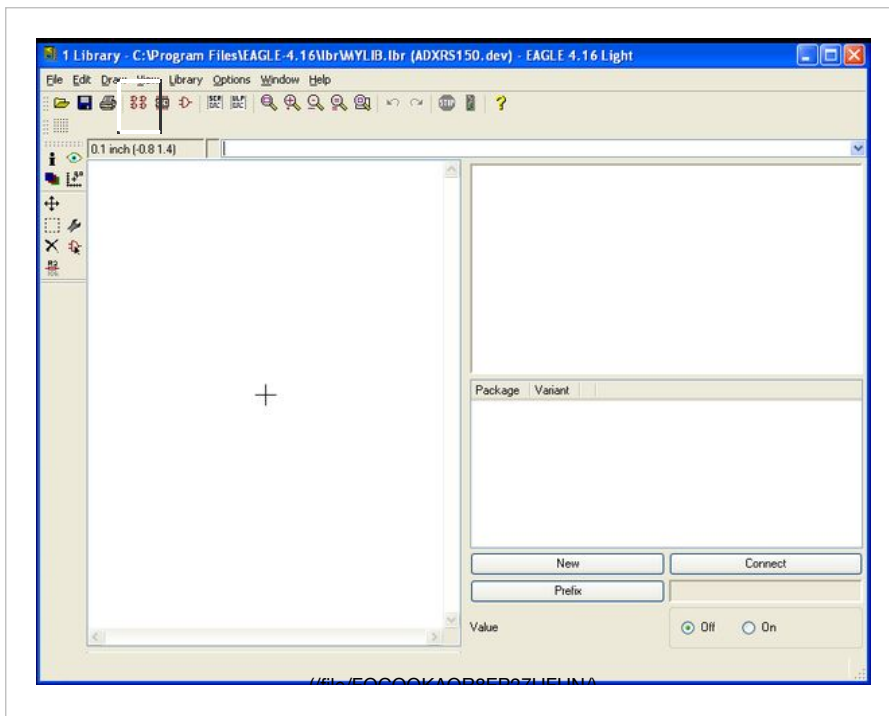
As great a names as P\$1-p\$32 are it will make our lives easier when we connect pins on the symbol with pads on the package if we use a more intelligent naming scheme. We will assign the names of the pins based on, you

guessed it, the data sheet.

Type name in the command window and double click on the pin to remain. A small dialog box will appear with the current name. Change the name and click "Ok". Repeat 32 times.

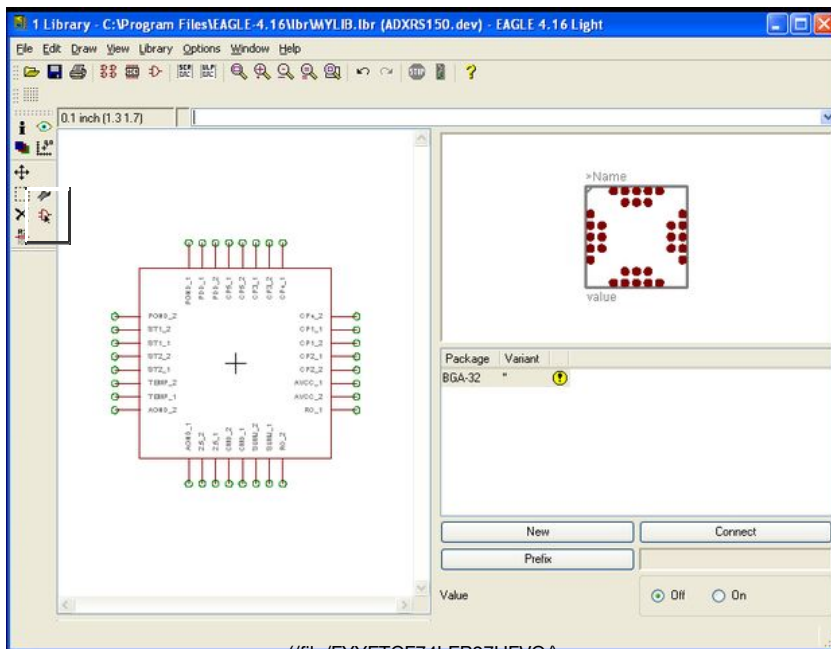
By default the name on the pin and the symbol will show up in the device. This makes for a very cluttered look. Click on the "change" button and select "visible" from the drop down menu, and then select "Pin". Then click on every pin. It will not be obvious what you are doing but trust me the final design will be easier to use.

Step 18: Make the device



In this step the association between the symbol and the package is made. Click on the devcie icon, add the name of your device, and your screen should like like this.

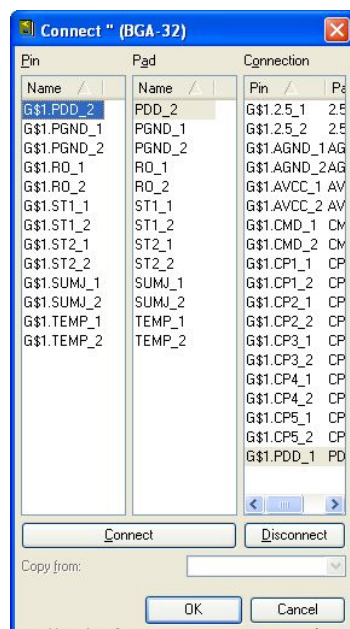
Step 19: add package to devcie



In the lower right hand corner click on the new button and select the package. Your package will show up in the upper right pane.

On the left vertical tool bar click on the symbol icon, and place your symbol in the left pane.

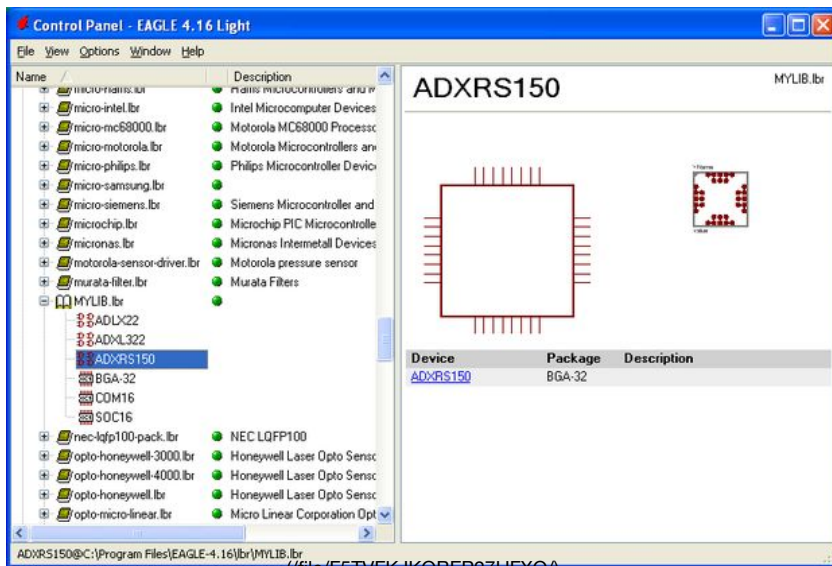
Step 20: Make connections



If you have followed my advice and named the pins on the symbol and the pads on the package the same this step should be easy.

Click on the connect button and the connect dialog box will appear. Keep clicking the connect button until all the connections are made.

Step 21: Save Device



CONGRADULATIONS!! YOU ARE DONE. Click on the save button. It always a good idea to check all is well, so navigate to your library, and expand it by clicking on the plus sign. You should see your device listed. Hightlight it and it will appear in the right hand pane.

Now get to work using your new device.

We have a be nice comment policy. Please be positive and constructive.

FEATURED CHANNELS

Mobile

Download our apps!

Android » (<https://play.google.com/store/apps/details?id=com.adsk.instructables>)

iOS » (<https://itunes.apple.com/app/instructables/id586765571>)

Windows » (<http://apps.microsoft.com/windows/en-us/app/7afc8194-c771-441a-9590-54250d6a8300>)

Home Repair
(/tag/type-id/category-workshop/channel-home-instrument/)

Survival
(/tag/type-id/category-outside-survival/)

Breakfast
(/tag/type-id/category-food/channel-breakfast/)

Minecraft
(/tag/type-id/category-play/channel-minecraft/)

Knitting
(/tag/type-id/category-craft/channel-knitting-and-crocheting/)

USB
(/tag/type-id/category-technology/channel-usb/)

Comics
(/tag/type-id/category-costumes/channel-comics/)

Winter Drinks
(/id/Holiday-Drinks/)

Weddings
(/howto/weddings/)

Newsletter

Join 2 million + to receive instant inspiration in your inbox.

About Us

[Who We Are \(/about/\)](#)

[Advertise \(/advertise/\)](#)

[Contact \(/about/contact.jsp\)](#)

[Jobs \(/community/Positions-available-at-Instructables/\)](#)

[Help \(/id/how-to-write-a-great-instructable/\)](#)

Resources

[For Teachers \(/teachers/\)](#)

[Artists in Residence \(/air\)](#)

[Gift Pro Account \(/account/give?sourcea=footer\)](#)

[Forums \(/community/\)](#)

[Answers \(/tag/type-question/?sort=RECENT\)](#)

[Sitemap \(/sitemap/\)](#)

Find Us

[Facebook \(http://www.facebook.com/instructables\)](http://www.facebook.com/instructables)

[Youtube \(http://www.youtube.com/user/instructablestv\)](http://www.youtube.com/user/instructablestv)

[Twitter \(http://www.twitter.com/instructables\)](http://www.twitter.com/instructables)

[Pinterest \(http://www.pinterest.com/instructables\)](http://www.pinterest.com/instructables)

[Google+ \(https://plus.google.com/+instructables\)](https://plus.google.com/+instructables)

[Tumblr \(http://instructables.tumblr.com\)](http://instructables.tumblr.com)

[Terms of Service \(http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=21959721\)](http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=21959721) |

[Privacy Statement \(http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=21292079\)](http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=21292079) |

[Legal Notices & Trademarks \(http://usa.autodesk.com/legal-notice-trademarks/\)](http://usa.autodesk.com/legal-notice-trademarks/) | [Mobile Site \(http://m.instructables.com\)](http://m.instructables.com)



[\(http://usa.autodesk.com/adsk/servlet/pc/index?id=20781545&siteID=123112\)](http://usa.autodesk.com/adsk/servlet/pc/index?id=20781545&siteID=123112)

© 2016 Autodesk, Inc.