# Getting Started with L-Edit

- L-edit is a Layout Editor. It is a product of


- EDA stands for “Electronic Design and Automation”
- http://www.tanner.com/eda/

# Layout

Layout is essentially a drawing process. You are drawing the two dimensional geometries that will end up on your mask.

Layout tools are essentially CAD drawing tools, but include additional useful features.

Every area of each mask will be either opaque or clear. That is what you are trying to define- which areas are which.

# Output

Your end product is a file which contains the data for your mask.

Standard format is GDSII (“Gerber Data Stream Information Interchange”). It includes information on the layers of your design and the 2D geometries.

Other common formats are CIF (Caltech Interchange Format), DXF (Drawing Exchange Format-AutoCAD), and Gerber (Printed Circuit Board-PCB) files.

Sometimes companies will charge you an additional fee to convert your CAD format into GDSII so they can make your masks.

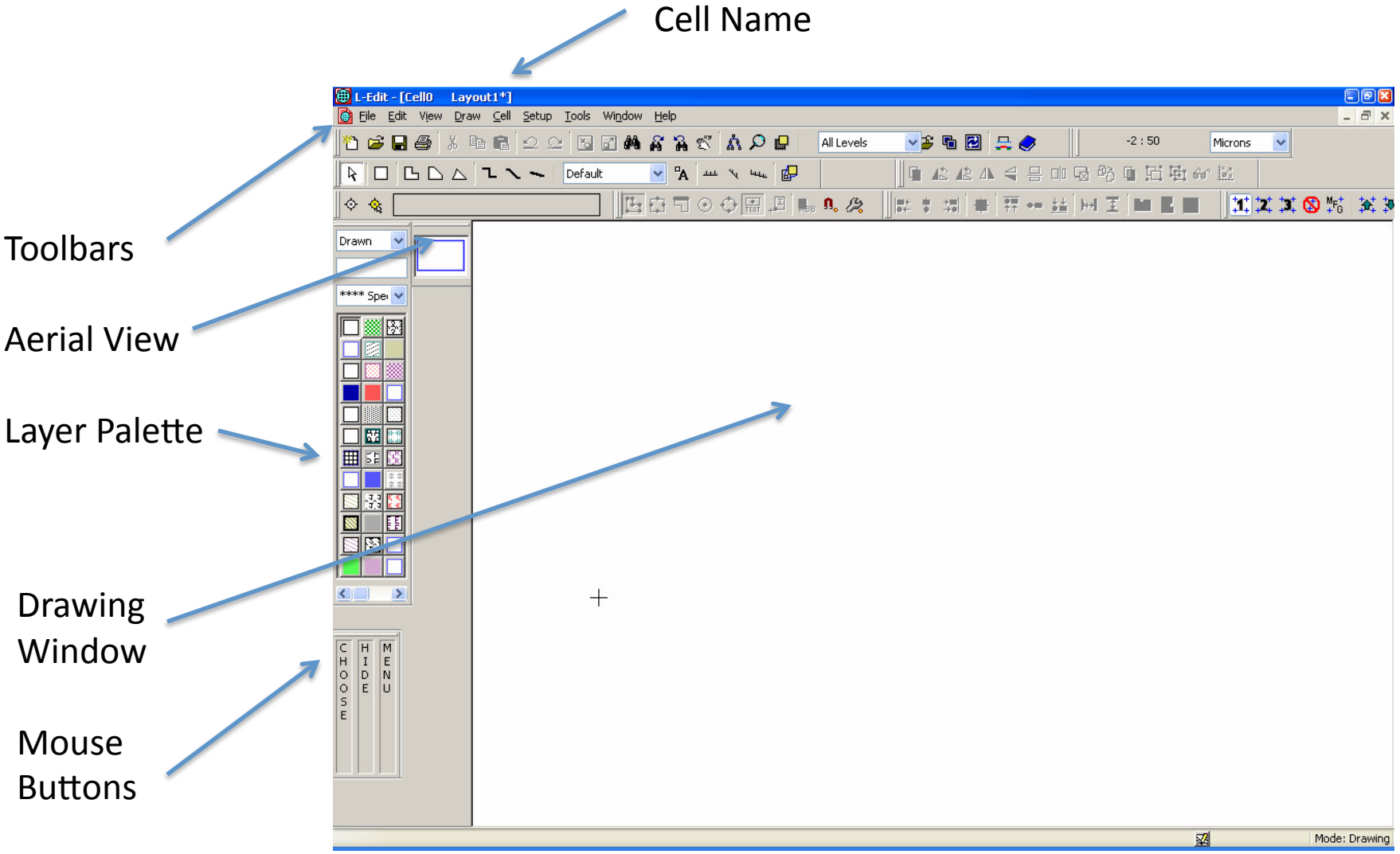
# Goal

We have a 2 layer process with 10 micron minimum feature size.

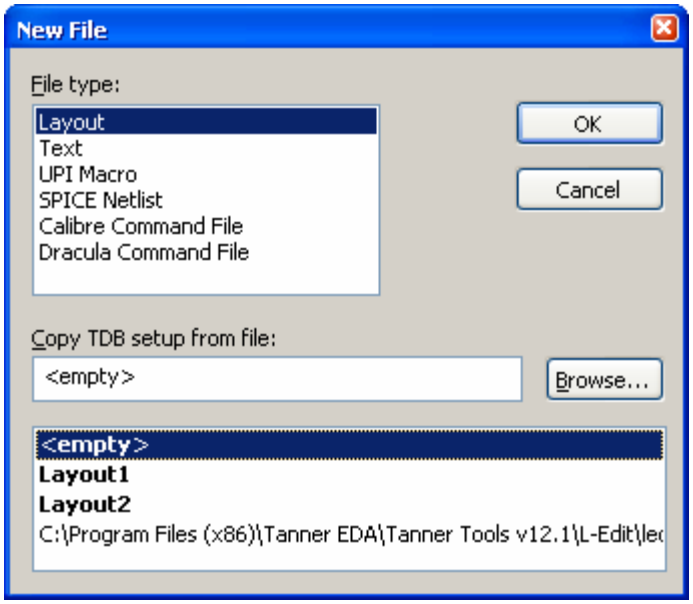
The two layers are:

- A nanochannel etch layer (GDSII layer 1).
- A microchannel etch layer (GDSII layer 2) where we etch through an aluminium layer to form reservoirs for the nanochannels.

# Launch L-edit



# Make a New File




This will create a new layout with a name like “Layout1” and with a single cell, “Cell0”.

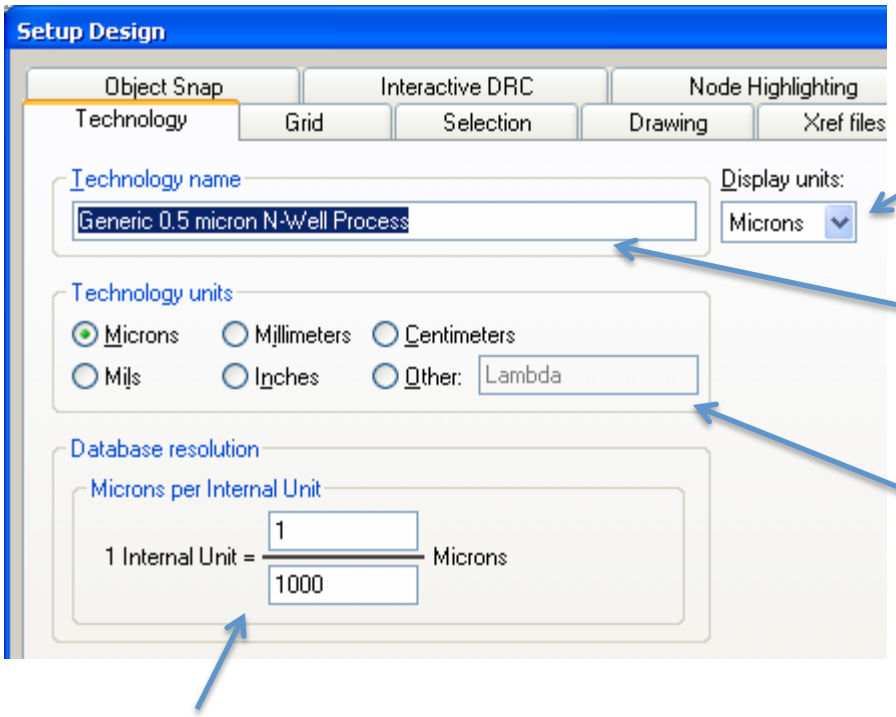
Make a new file of type “Layout”.

“TDB” is “Tanner DataBase”- your layout will be saved in a TDB file, a proprietary Tanner format.

If you want to copy setup information from an existing TDB file, browse to it.

(For instance, this could copy Design Rules and Layer Names). Select <empty> for a new file with no setup information.

# Setup Technology




**Go to Setup | Design.**
**Technology tab.**

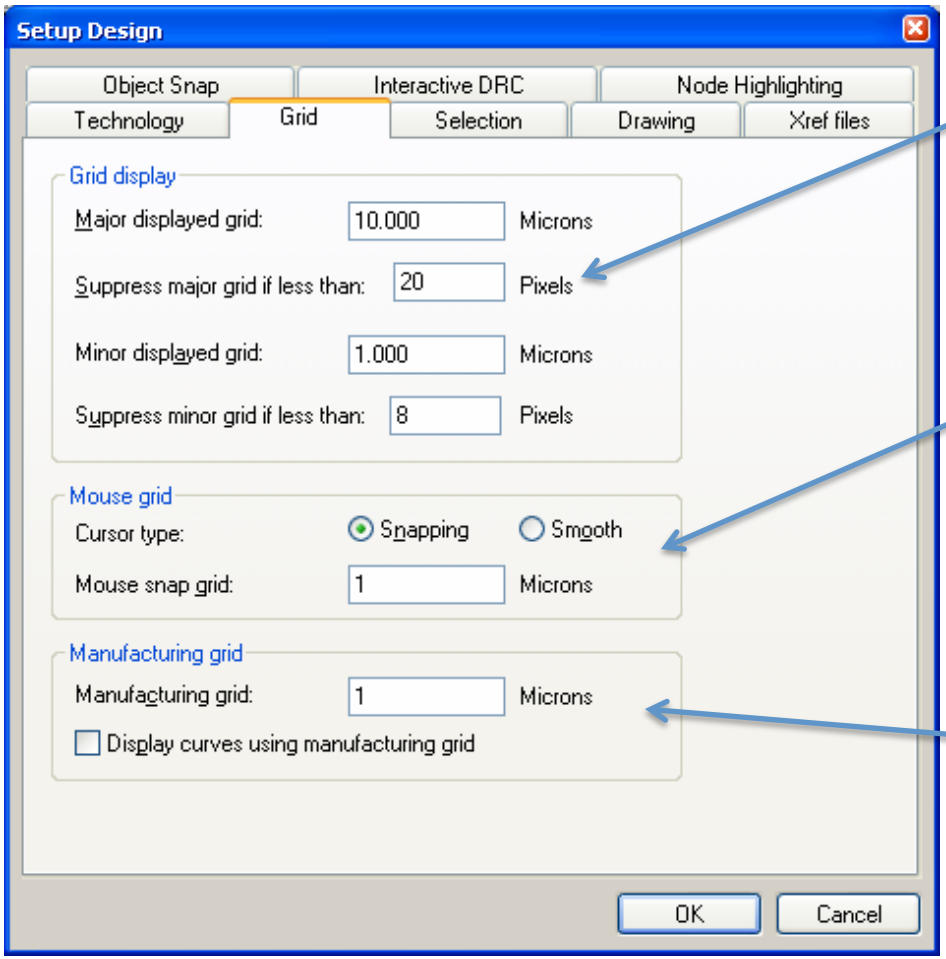
As displayed on screen. Microns is a good default.

Create a name for your fabrication process.

This is the unit in the technology that is, the fabrication process. What is the natural unit to work in? For 0.18 micron process, it would be 0.18 microns.

Internal units are what is actually used in L-edit to store the information. This is **not what is displayed to you (see display units above).** However, you need to know this when you export your final design to GDSII. The default for GDSII is that one database unit is 1 nm (1/1000 microns). This will be the smallest increment you can store, and will also determine the max size of your design. L-edit max size is -536,870,912 to +536,870,912 units; at 1 nm = 1 internal unit, this is something like 42 inches on a side. **Keep default of 1 nm per internal unit.**

# Setup | Design | Grid

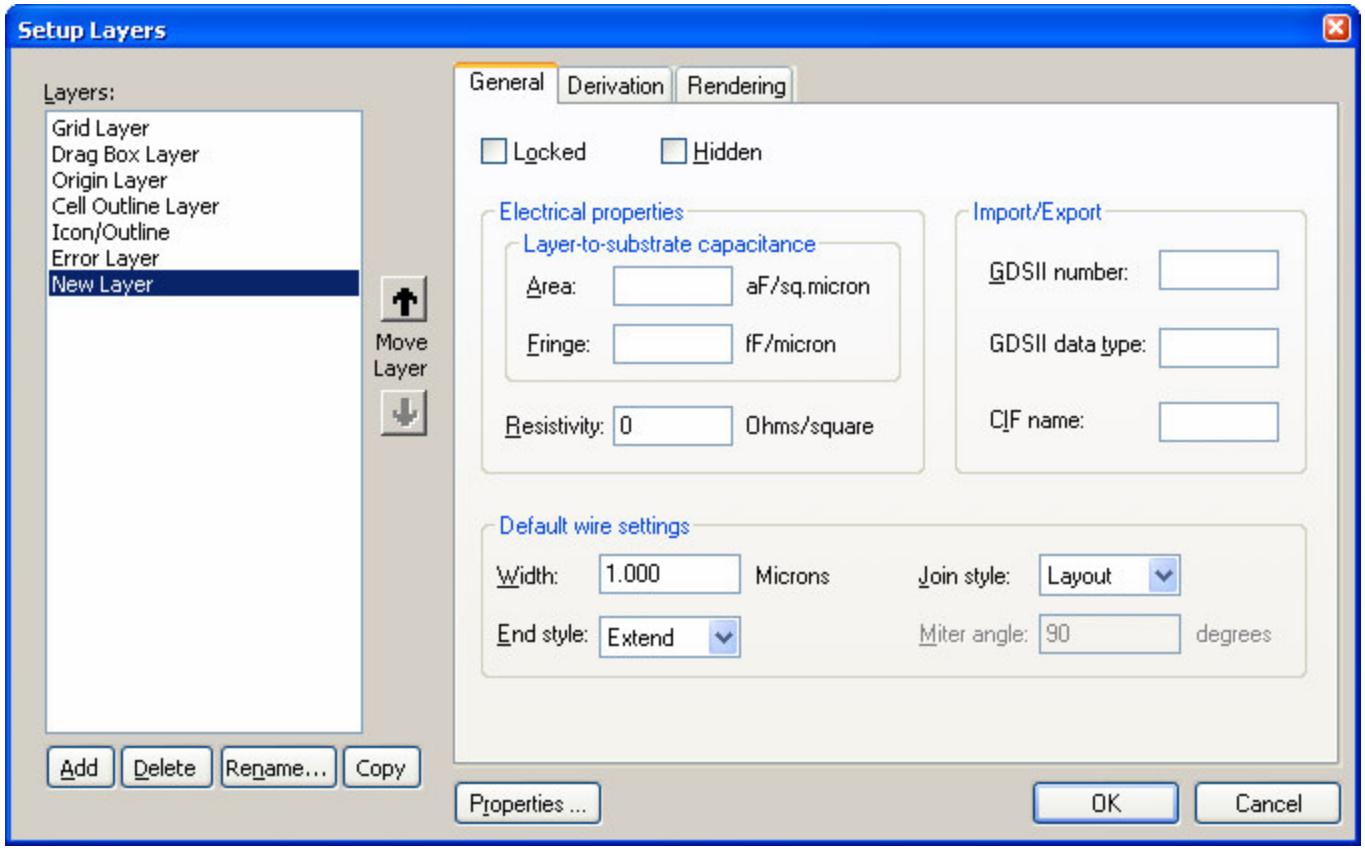



These are just the dots shown on the screen.

This is where your mouse will snap to. If you want to make sure you don't make anything smaller than your minimum feature size, set the mouse snap grid to your minimum feature size.

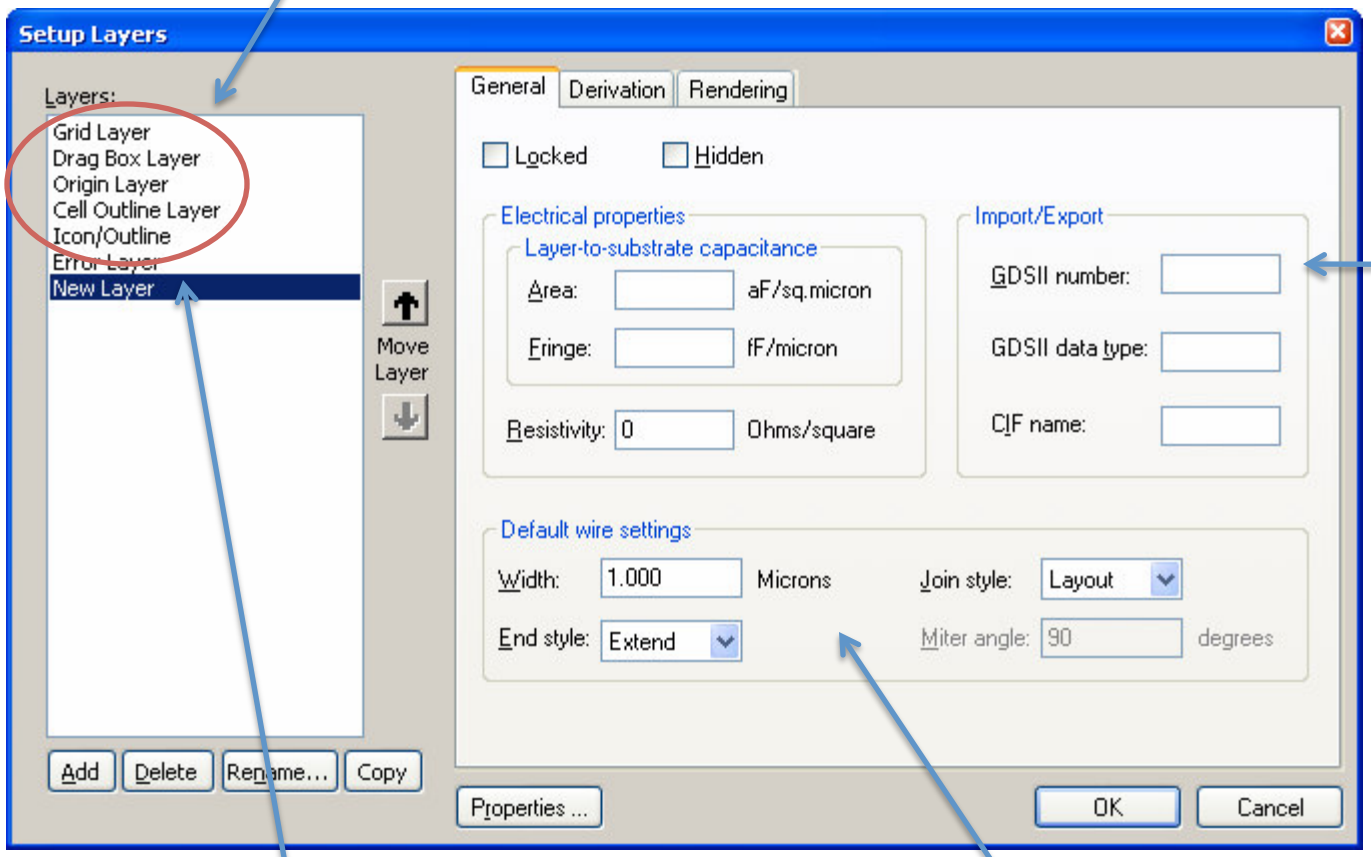
This is the minimum feature you can make in your process.

# Setup Layers




Create all the layers you want in your design. Easiest thing would be one layer per mask. You can set the appearance of the layer (color and pattern) under “rendering”. We will talk about derived layers later.

Used by L-edit- don't mess with them




When you export to GDSII or CIF, this layer will be exported as that GDSII or CIF layer

Add layers you want… define their name and rendering.

If you plan to make wires in that layer, you can set a default wire width and end/join style.

# Task 1

1) Create a new layout with an <empty> setup.

2) Make sure working units are microns and internal units are nm.

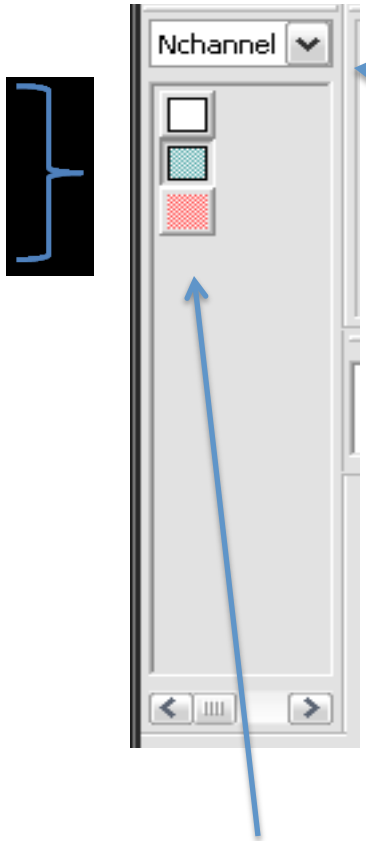
3) Set mouse snap to 5 micron and manufacturing grid to 1 microns.

4) Define two layers: nchannel and mchannel. Give them some interesting color/pattern so you can tell them apart.

5) Set the GDSII layer numbers to 1 for nchannel and 2 for mchannel.

# Layers

Here are all the layers in your layout. They can correspond directly to masks, or they can correspond to logical units (such as anchors, holes, structures, channels) which may eventually be group together into a single layer to make your mask.

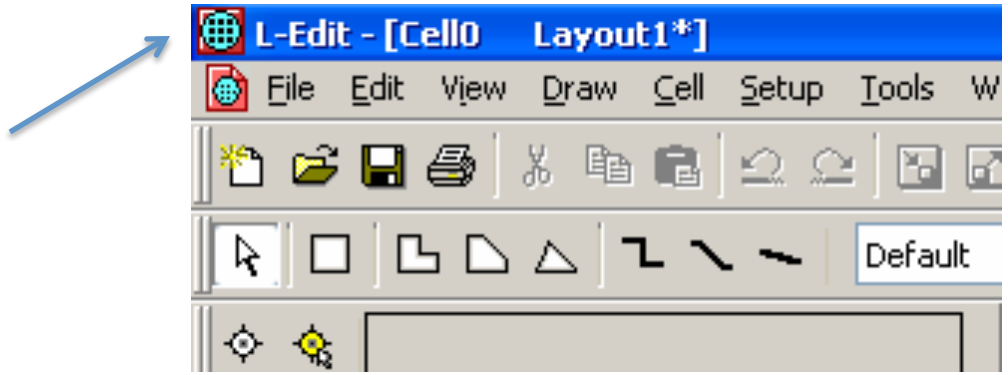



You can select which layers are visible in the pallete

Mouse over a layer button to make the layer active, and to hide and show it.

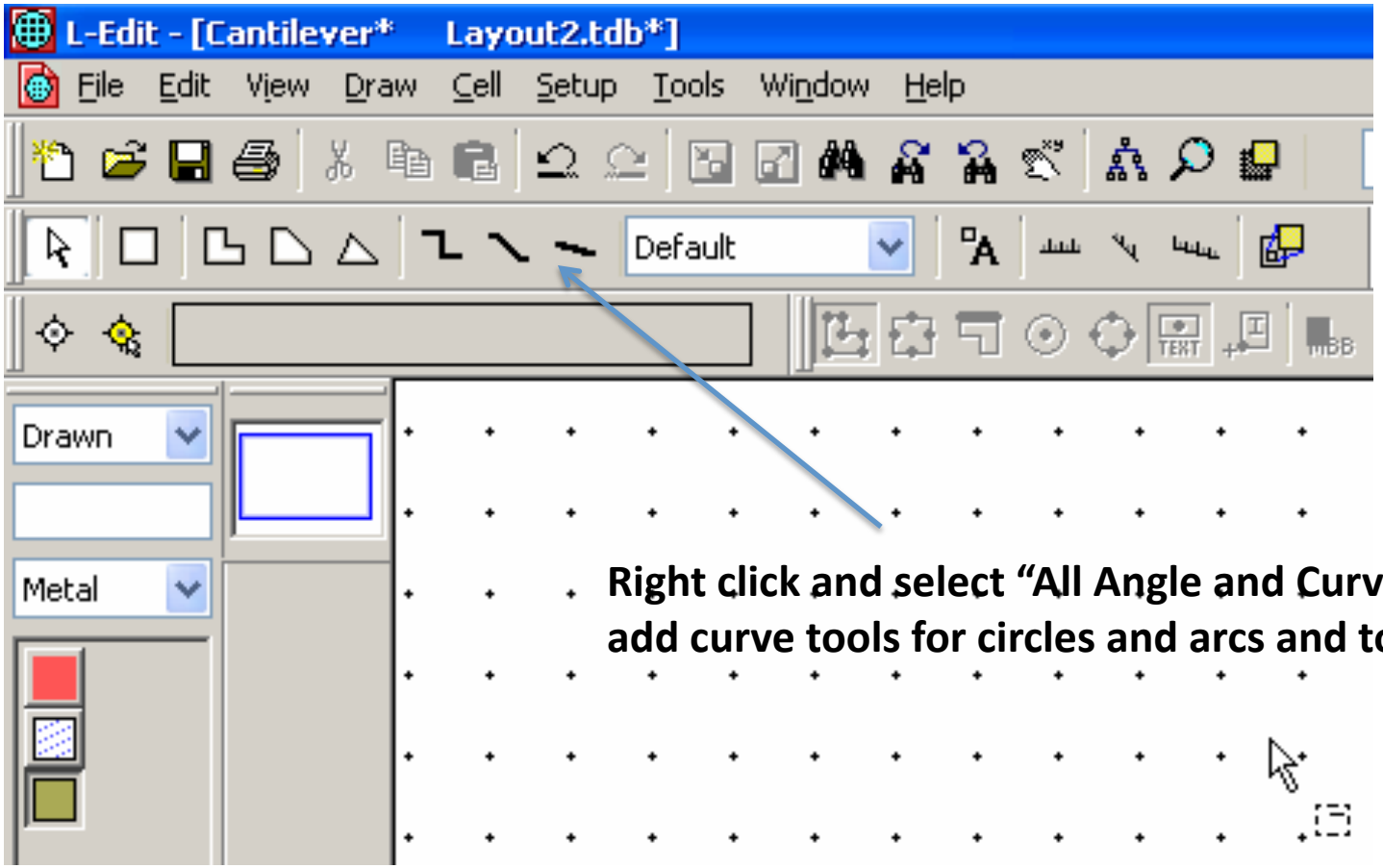
# Cells

This is the name of the cell within the current layout. You can have multiple cells within a single layout

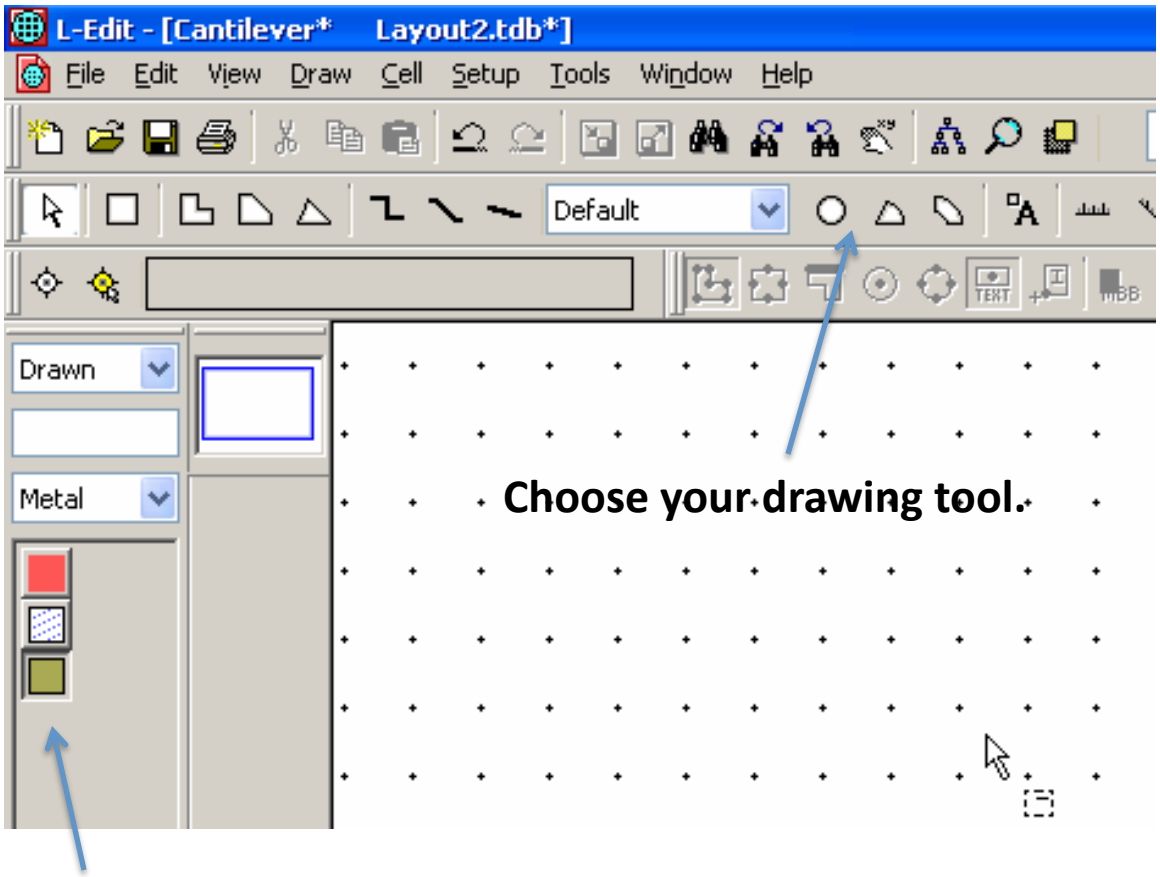



A cell within your layout is some **logical entity; often something you want to duplicate many times. For instance, if you have a layout with many identical chips** in it, you may design the chip as a single cell, and then array the cell many times to create the overall layout. Then if you need to make a change you just change the cell and all the instances of that cell update

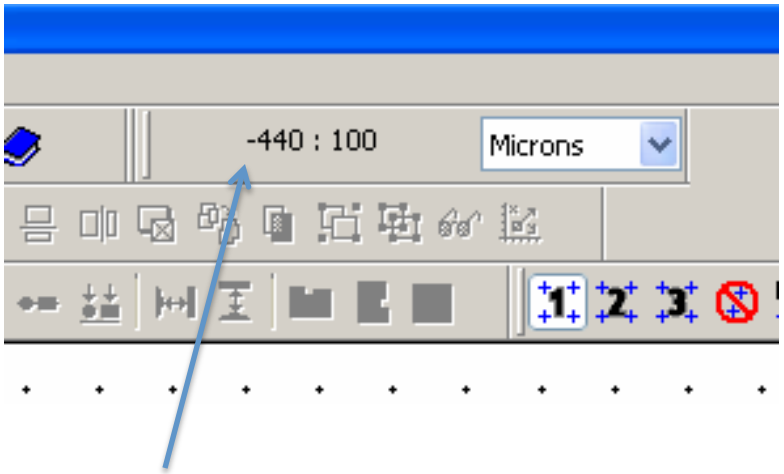
# Drawing


L-Edit - [Cantilever*  Layout2.tdb*]
File Edit View Draw Cell Setup Tools Window Help
Default
Drawn
Metal
Right click and select “All Angle and Curve” to add curve tools for circles and arcs and toroids.

# Drawing


L-Edit - [Cantilever*  Layout2.tdb*]
File Edit View Draw Cell Setup Tools Window Help
Default
Drawn
Metal
Choose your drawing tool.
Select your working layer

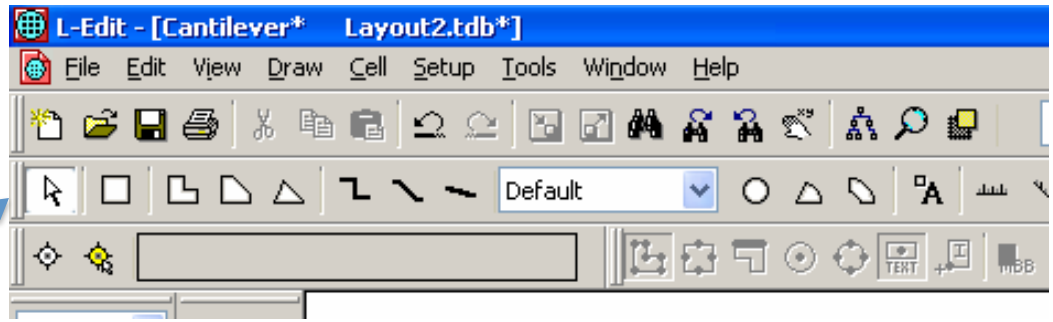
# Mousing




This will display the current cursor location.

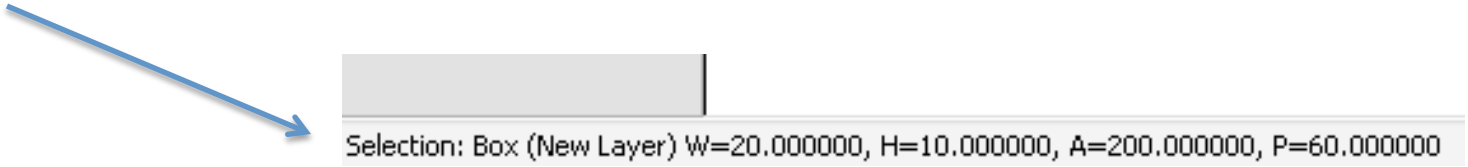
As you mouse around, this spot shows which each mouse button does. If you hold down shift, control, or alt, you will get different options.

# Selecting

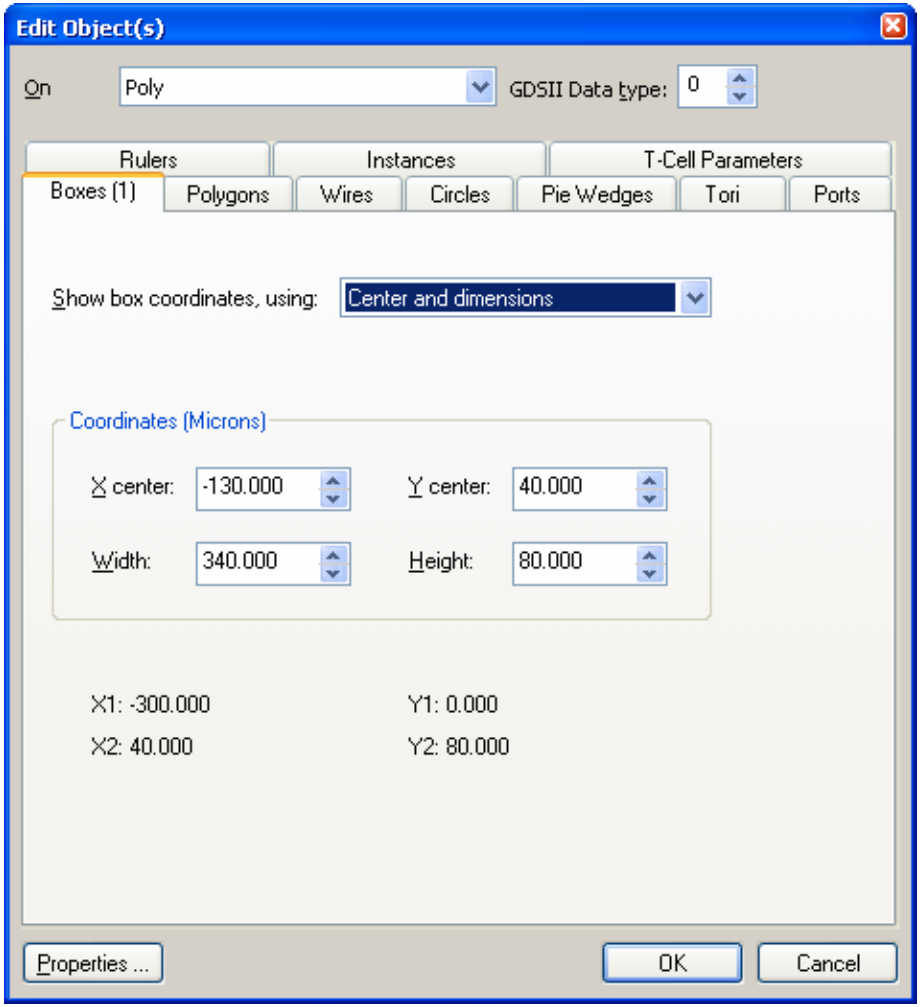



Choose your select tool. You can only select items on visible layers.

At the bottom left of the screen it will tell you what you selected.



# Editing




Select the object you want to edit and press **“Ctrl+E”.**

A dialogue box will pop up. You can now change the layer the object is on, the dimensions of the object and so forth.

# Moving

There are a few options to move objects in L-Edit:

(1) Select the object, press ‘Alt’ and drag it to the new position

(2) Select the object and hit ‘M’. You can now define an exact move.

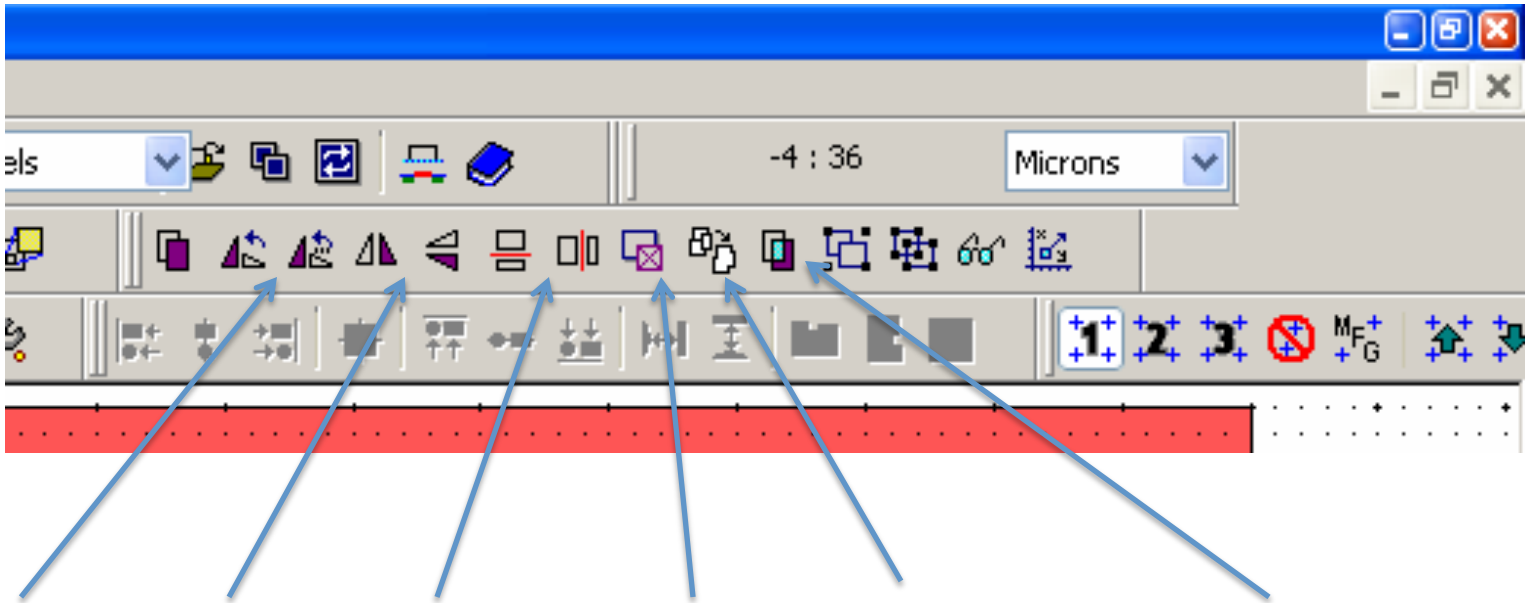
# Copying

You can copy and duplicate objects:

(1) To copy: Select the object and press ‘Ctrl+C’. Then press ‘Ctrl+V’ to paste the object onto the active cell. You can now move the object where you want it.

(2) To duplicate: Select an object and press ‘Ctrl+D. Now hold ‘Alt’ and drag the selected object to the new position. Duplicating is a very useful tool when you want to repeat the action a number of times.

# More Editing




**Rotate** **Flip** **Slice** **Nibble** **Merge**

**Perform boolean operations (And, Or, Subtract, Shrink and Grow… and results can end up on any layer.)**

# Zooming and Panning

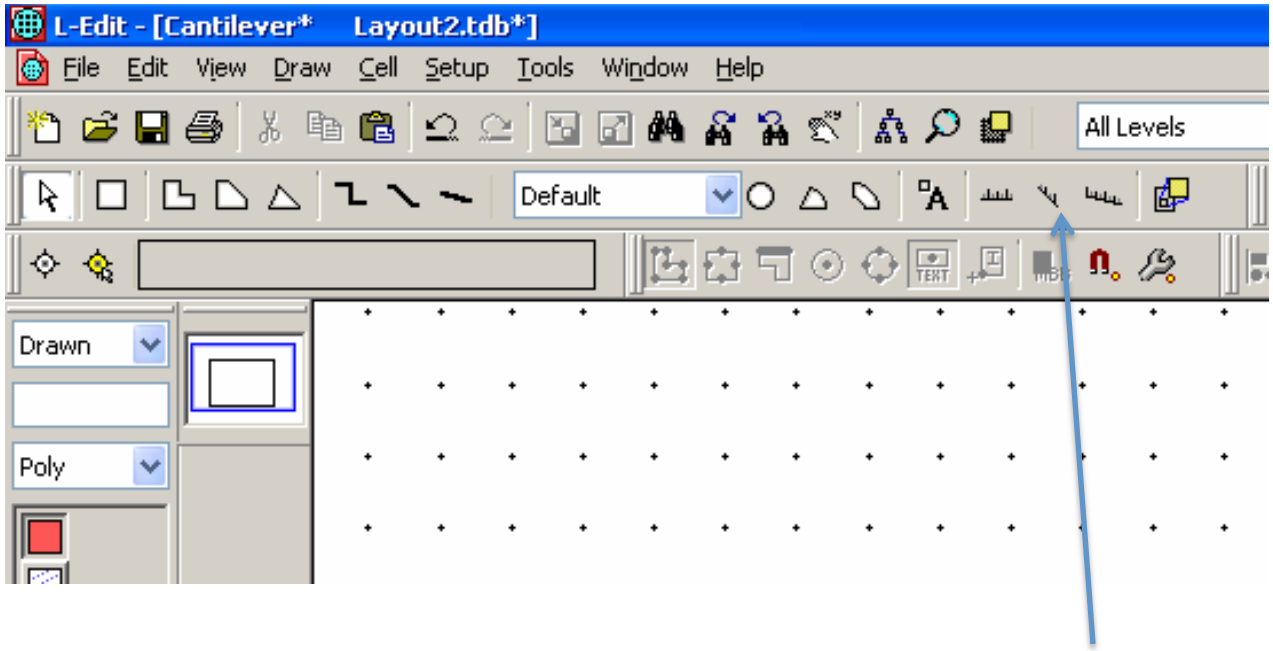
+ and – keys zoom in and out.

‘Home’ key zooms to see everything.

‘Z’ puts you in zoom mode, then left button zooms in on a boxed area, middle button pans, right button zooms out.

Arrow keys pan around the design.

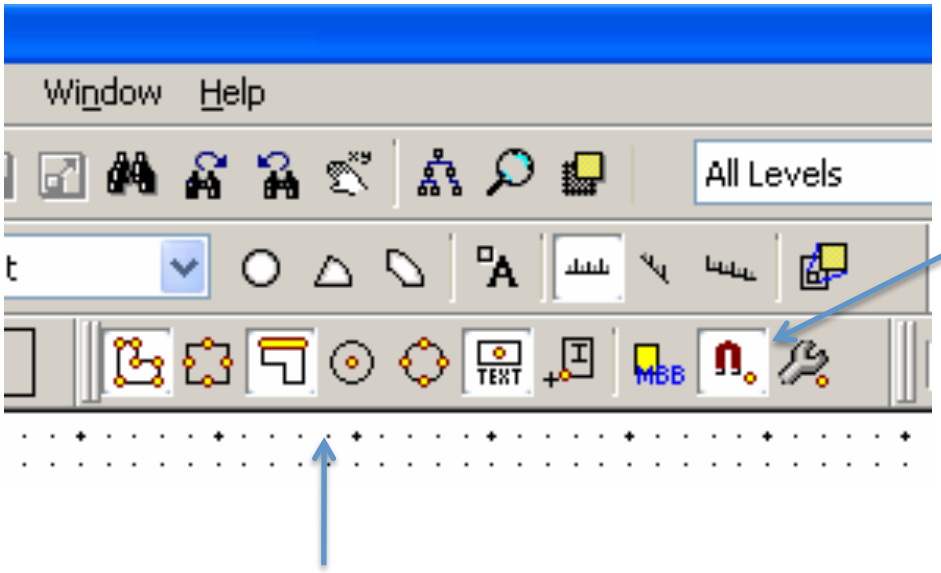
# Measuring




If you push “q” your current cursor location will become 0,0 and you can move to a new spot and see where you are. Push “q” again to go back to global coordinates.

You can use a 90 degree, 45 degree or all angle ruler. It will tell you the ruler length at the bottom left of the screen. If you want to read the ruler writing, you may need to select and edit the ruler and change font size.

# Object Snap




Turn on object snap if you want it by clicking this magnet button.

You can determine what kinds of things (vertex, edge, center, etc.) you snap to by selecting these buttons.

# Arraying Cells

Once you have a cell designed, you can create an array from it.

Go up to your top level cell (Cell0). (Use "window" menu)

Say "cell|instance" and select the cantilever cell.

Then push Ctrl-e to edit cell parameters, including arraying.

# Task 2

1. Draw a channel in the nchannel layer which is 20 micron wide and 5mm long.

2. Draw two boxes in the mchannel layer which are attached to the channel as shown. Note the 25 micron overlap.

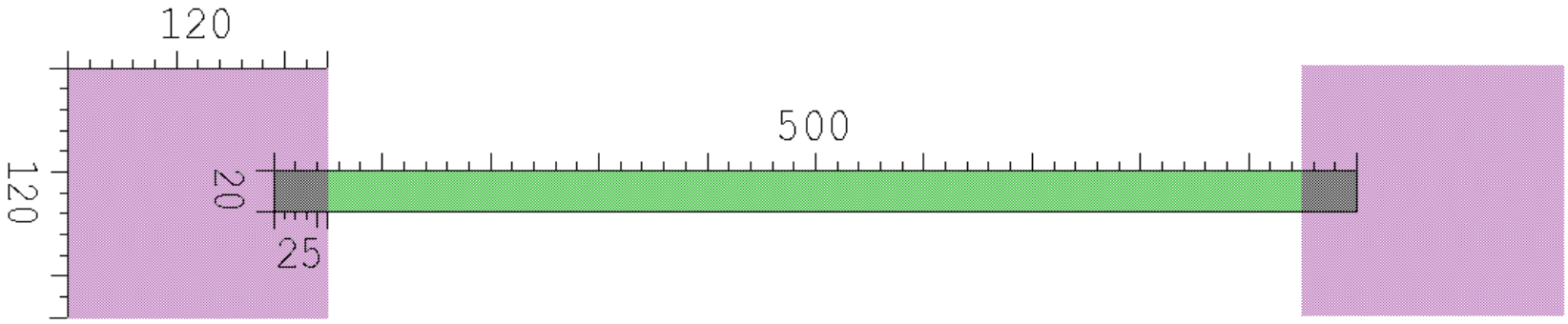



Figure 1

3. Now add a scale below the nanochannel as shown. You will need to play with the scale options to do this.

4. Your final design should look like Fig 2. Save the file as First-name Last-name initial_HW1 (e.g. CherryG_HW1.tdb)

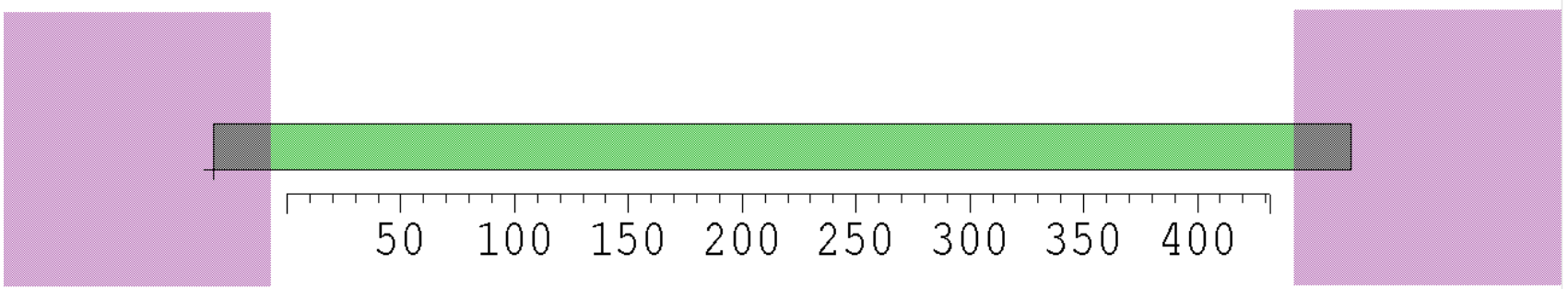


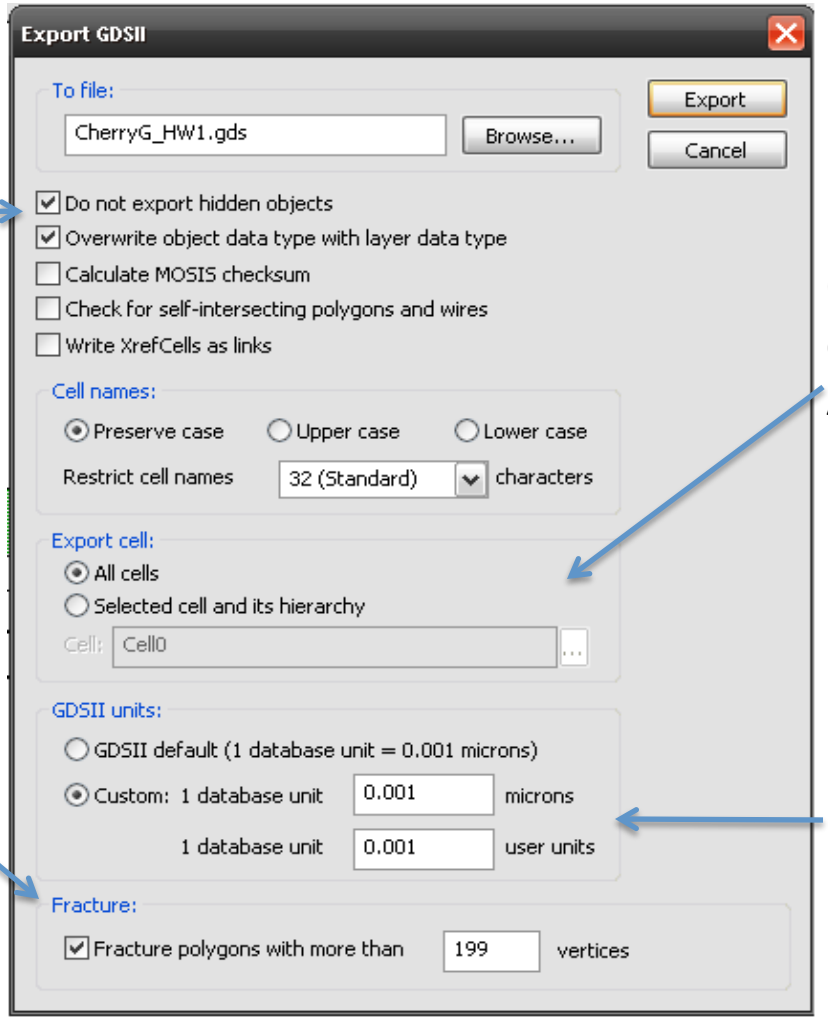

Figure 2

5. The next slide will take you through the process of exporting files. Export your file in both .gds and .dxf format with the same naming convention as given before. (You only need to turn in the .gds file)

6. Finally, print out your .tdb file to scale (set the scale as 1000 micron per cm).

# Generating the Final GDSII

**Make sure the layers you care about are not hidden!**




Choose which cell to export. All sub-cells will be exported too

GDSII polygons have a maximum number of vertices – will break up any huge polygons (especially curves!) into manageable smaller pieces

Use default GDSII or custom for the same

```
GDSII Export...
TDB File: C:\Documents and Settings\cherry\My Documents\Coursework\TA'ed courses\ME 141 Spring 09\L-Edit\Assig 1.tdb
GDSII File: C:\Documents and Settings\cherry\My Documents\Coursework\TA'ed courses\ME 141 Spring 09\L-Edit\Assig 1.gds

Option Settings:
Do not export hidden objects: ON
Overwrite data type on export: ON
Calculate MOSIS checksum: OFF
Check for self-intersecting polygons and wires: OFF
Write XRefCells as links: OFF
Preserve case of cell names: ON
Restrict cell names to 32 characters.
All cells are being exported
Use custom GDSII units:
     1 database unit = 0.001 microns,
     1 database unit = 0.001 user units.
Fracture polygons: OFF
Manufacturing grid for circle and curve approximation: 0.050 Microns
All ports with port boxes will be converted to point ports

Checking X-Ref Cell links ...Cannot open X-Ref file "c:\documents and settings\cherry gupta\desktop\layout3.tdb", for details see the following 1 warnings.
   1) Cell: Cell0 (version 1.01)


Checking GDSII Numbers ...

Checking for Hidden Layers and Objects ...
Warning #12: Found objects in cell Cell0_New on layer ndiff with no GDSII number (Action: Ignored these objects)

Writing actual GDSII data ...
Warning #26: Cell Cell0_New is empty. (Action: Written as empty cell.)

Completed writing actual GDSII data ...

Summary:
Export completed - 0 error(s), 2 warning(s)

Elapsed Time: 0.03 seconds
```

Check the log that pops up for errors and warnings.

# References

- L-Edit help documentation
- ‘Tanner EDA L-Edit tutorial’, Robert White