

# CAD at CNF using L-Edit

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## CNF L-Edit Web Site

For the latest information about the current version of L-Edit, click **Computing on [www.cnfusers.cornell.edu](http://www.cnfusers.cornell.edu)**, then click **Software Tools, L-Edit CAD Software**, and **Using L-Edit v2020** (or more recent version).

## Terms

**GDSII:** Industry standard exchange format for Electronic CAD data. Also called GDS (Graphical Data System), STREAM, or CALMA. Usually, your CAD data will be converted to GDS, and then the GDS data will be converted into machine-specific instructions to actually expose your mask or wafer.

**Cell:** The building block of your pattern, containing geometric figures, text, and possibly references to other cells or arrays of cells. (Simple patterns typically are a single cell. More complex ones will usually have a hierarchy of cells.)

**Layer:** Primarily a mechanism to identify distinct lithography steps in your pattern, but may also be used for tone-reversal, notes, and certain special cases. GDSII contains a maximum of 64 layers, numbered 0 to 63, with 63 reserved for a cell boundary.

**Layout or Library:** File keeping track of your various cells, layers and similar pieces. You can have more than one structure in this file. L-Edit layout files have extension **.tdb** (Tanner database).

## *Important*

- **Do not use layer 0** (zero). Some conversion routines and utilities don't handle layer 0.
- Cell names may be truncated to 5 characters by the conversion programs, so **make the first 5 characters of each cell name unique**.

## To Start L-Edit...

- On a Windows PC at CNF, double-click the LED icon on the desktop.
- If you have logged into a CNF ThinLinc server with the ThinLinc client on a CNF diskless workstation or on your own computer, click on **Korat** or **Minx** in **Applications**→**CNF**. You will be logged in automatically. Then type `ledit` to start L-Edit in the Wine Windows emulator.

## In L-Edit...

- **Our preferred layer setup is with numerical names that are the same as GDS layer numbers.** If this is not the case when L-Edit starts, and you want to set up L-Edit this way, open the following file on the System disk: `/usr/local/cnf/ledit/ledit.tdb` or `X:\shares\public\processes_from_cnf_staff\Computing\CAD\L-Edit\ledit.tdb`
- **Save ledit.tdb as a file with a different name in W:\private** on a CNF Windows PC, or if you are using Korat or Minx, create a folder in `/scratch` and save it there. **Be sure to copy your folder to a more permanent location later!**

- To reduce clutter, click on **Toolbars** in the **View** menu and uncheck everything except **Standard**, **Drawing**, **Editing**, and **MultiGrid**. Then close extraneous windows such as **Verification Navigator**, **SDL Navigator** and **Command Line**, and in the **Libraries** window click on the **Layer Palette** tab.
- The manufacturing grid size should usually be left at its default value of 0.001  $\mu\text{m}$ , but it can be changed to adjust how circles and curves are converted to polygons. Toggle display of curves using the manufacturing grid in **Setup**→**Design**→**Grid tab**. Also on the **Grid tab**, you can change the spacing of displayed grid dots and control the size of the grid that vertices of shapes snap to. **For e beam lithography, the grid size must be 0.001  $\mu\text{m}$ .**
- **Edit** a selected object (**Ctrl-E** is the shortcut) to change location, size, or, for a cell instance, make and/or adjust an array.
- For Heidelberg laser writers and JEOL e beam lithography systems, **the pattern must be in a rectangle with the origin in the center**. In CNF's preferred layer setup, layer 16 is not filled with a color, so draw a rectangle on layer 16 and edit it to have its center at (0,0) and its height and width larger than one device. If lithography will be done with a stepper, the rectangle should also be no larger than the maximum die size. Draw everything else on layers other than 16, and discard layer 16 during conversion to the mask maker format or e beam format.
- The mouse buttons are context-sensitive. On the screen, it will display what the current definitions are.
- **To create a regular polygon as an instance in your cell**, according to values you specify, first see how to access the .tdb file that can create the cell by reading the "*Instantiating a Cell from an External Library*" section on the CNF L-Edit web site referred to at the beginning of this handout. Then use **Cell** → **Instance** and choose the **CNF Polygon Generator** cell and fill in the table of parameters. An octagon is the simplest shape that approximates a circle. While the polygon is still a cell instance, you can edit it and make an array. To replace the instance with the actual polygon, use the **Ungroup** button in the Editing toolbar.

## Export GDS file

- Use **File**→**Export mask data**→**GDSII** and put the GDS file in W:\private if working on a PC, or your private folder if working on Korat or Minx.
- Check the box to **Fracture polygons with more than 199 vertices**, since our conversion software has a limit of 199 vertices per polygon.
- GDSII units should be the **GDSII default (1 database unit = 0.001  $\mu\text{m}$ )**
- Cell names must be **Upper case**. Some conversion routines and utilities don't handle lowercase cell names.

## Check GDS file

**It is cheaper, quicker and easier to check your results at this point, instead of later, when you start wondering about the missing or extra shapes on your completed mask.** Quit and restart L-Edit, then use **File**→**Import mask data**→**GDSII** to import and inspect the GDS file.

## Transfer GDS file to conversion server

- To put your GDS file in the right place for conversion to the format of the Heidelberg laser writer mask maker, copy it to V:\Heidelberg DWL2000 (on a CNF Windows PC) or to /cnflab/Heidelberg DWL2000 (on korat or minx). (Note: in the cleanroom the lab transfer file system may be called Z: instead of V:)
- To convert the GDS file to e beam lithography formats with LayoutBEAMER, copy or move the GDS file to **W:\private** if it is not already there (on a Windows PC) or to the private directory in your home directory (on korat or minx). When you run LayoutBEAMER (by typing beamer) on korat or minx, the GDS file will be accessible from that location.