# Lecture 8- Introduction to CAD

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# Outline of this Lecture

- Previously on ELCN321
- Computer Aided Design
- L-Edit
- Layout of an inverter

# Previously on ELCN321

## Layout Design Rules

Design rules specify to the designer certain geometric constraints on the layout so that the patterns on the processed wafer will preserve the topology and geometry of the designs.

The areas handled in the design rules are:

- Minimum width of lines to avoid breaks in a line
- Minimum spacing between lines to avoid shorts between lines
- Minimum required overlap and enclosure between layers

# Previously on ELCN321

## Layout Design Rules

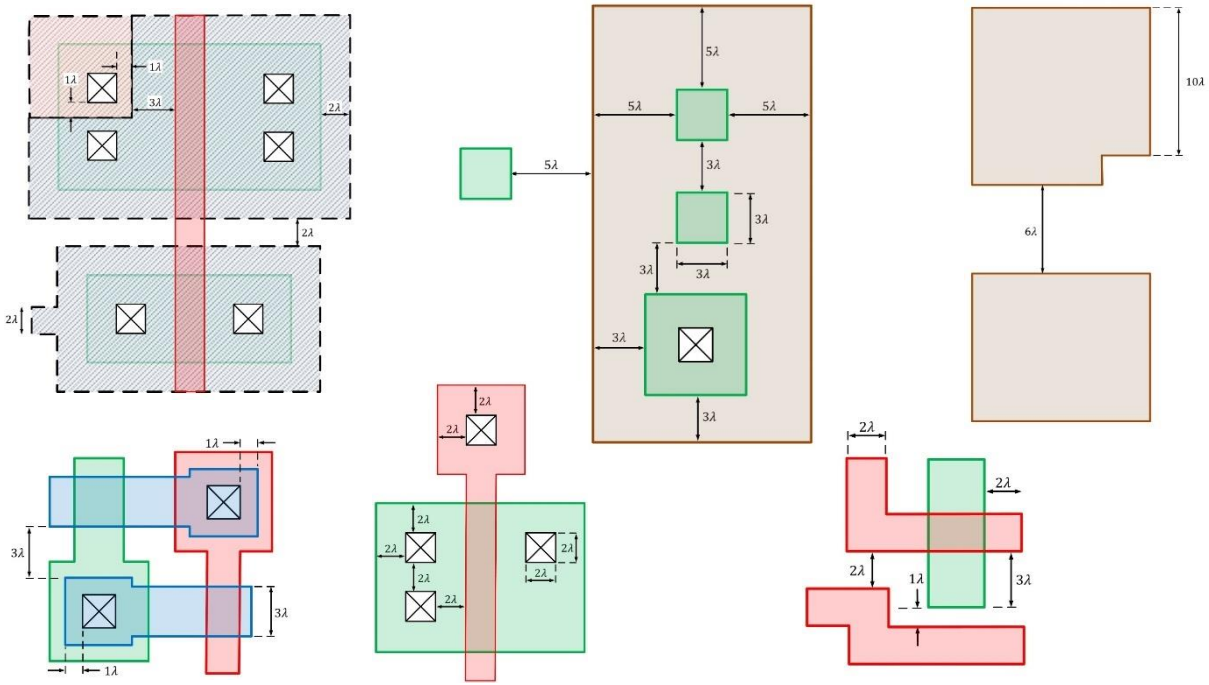
Industrial design rules are usually specified in **microns**. This makes migrating from one process to a more advanced process or a different foundry's process **difficult** because not all rules scale in the same way.

Mead and Conway popularized **scalable** design rules based on a single parameter, $\lambda$. $\lambda$ is generally half of the minimum drawn transistor channel length (feature size).

Drawing the layout in terms of $\lambda$ helps in migrating from one technology to another (useful for digital, not much in analog).

# Previously on ELCN321

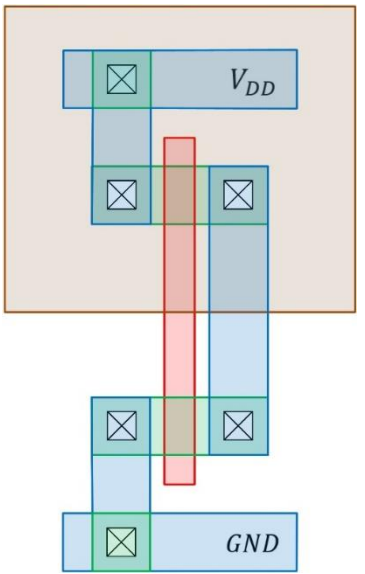
## Layout Design Rules

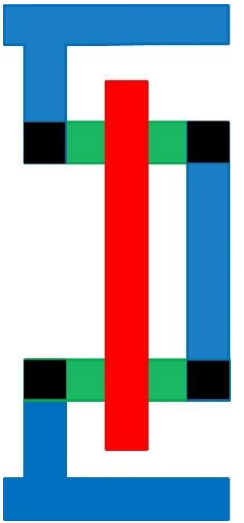


# Previously on ELCN321

## Stick Diagrams

Stick diagrams are easy and fast way for the designers to plan cells and estimate area before committing to a full layout.





Well Active Poly Metal Contact N-select P-select

# Computer Aided Design

## Definition

Computer aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design.

CAD software is used to increase the productivity of the designer and improve the quality of design

Electronic design automation (EDA) is a category of CAD tools for designing electronic systems such as integrated circuits and printed circuit boards. Since a modern semiconductor chip can have billions of components, EDA tools are essential for their design.

# Computer Aided Design

## Definition

Since a modern semiconductor chip can have billions of components, EDA tools are essential for their design.

Example of the CAD companies are: Cadence, Mentor Graphics Synopsis, and Tanner.

# L-Edit

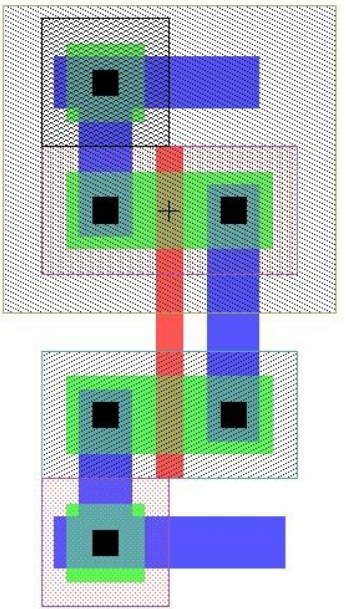
## Definition

L-Edit is an integrated circuit layout tool from Tanner used to draw two dimensional geometry of the masks used to fabricate an integrated circuit.

Different layers are represented by different colors and patterns.

Manufacturing constraints can be defined in L-Edit as design rules.

L-Edit files are saved as file_name.tdb (Tanner Database).



# L-Edit

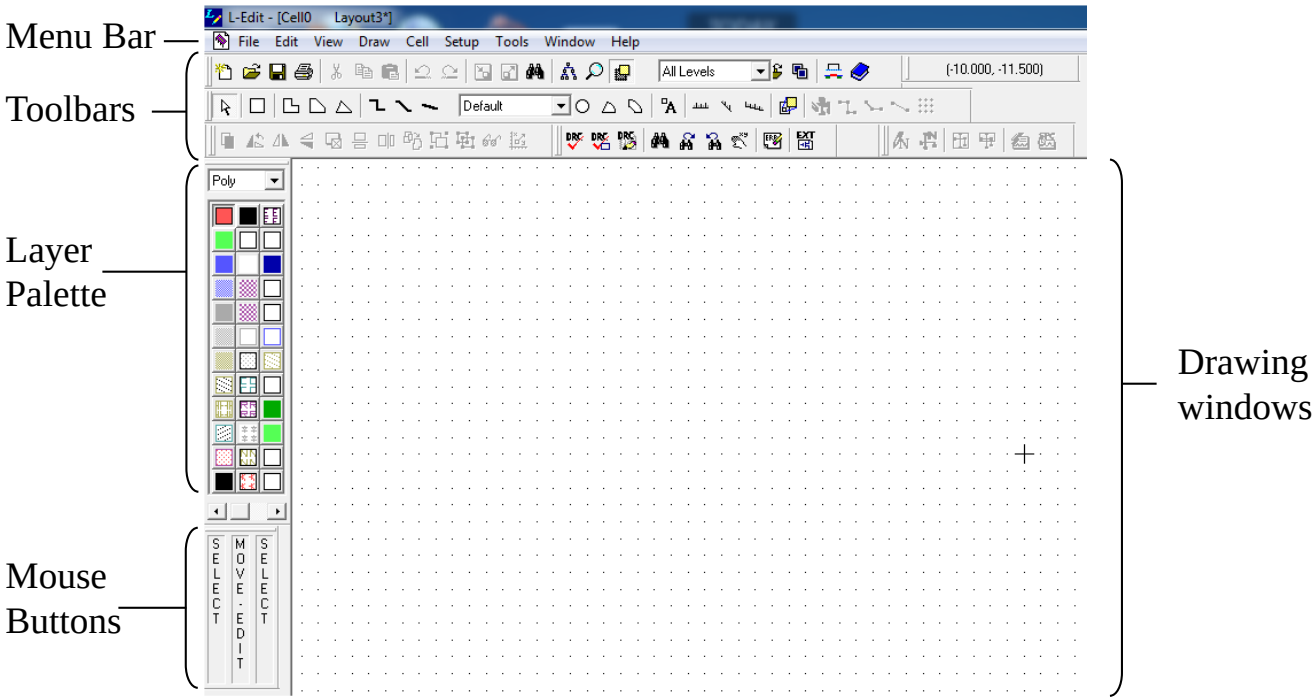
## L-Edit Modules

L-Edit has four main modules:

- **L-Edit:** The layout editor.
- **L-Edit/DRC:** The Design Rule Checker.
- **L-Edit /Extract:** The layout extractor to SPICE.
- **L-Edit /SPR:** an automatic standard cell placement and routing.

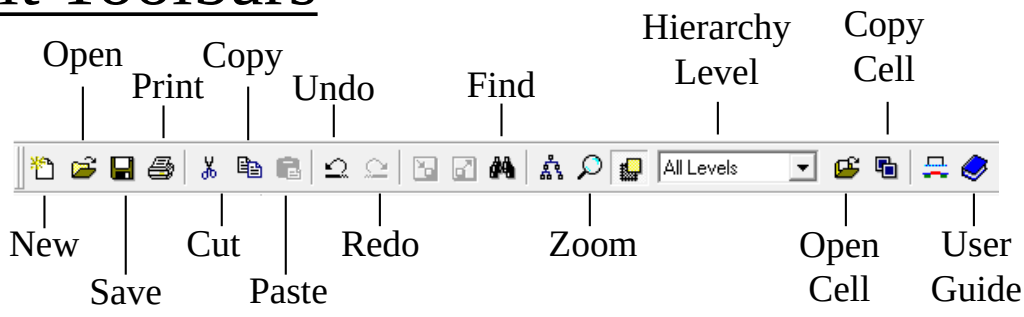
# L-Edit

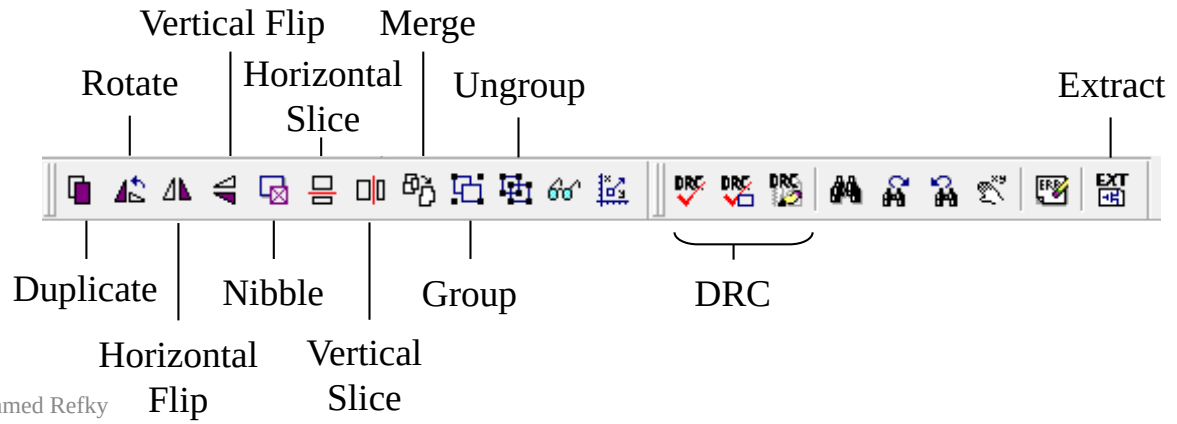
## L-Edit Main Window



# L-Edit

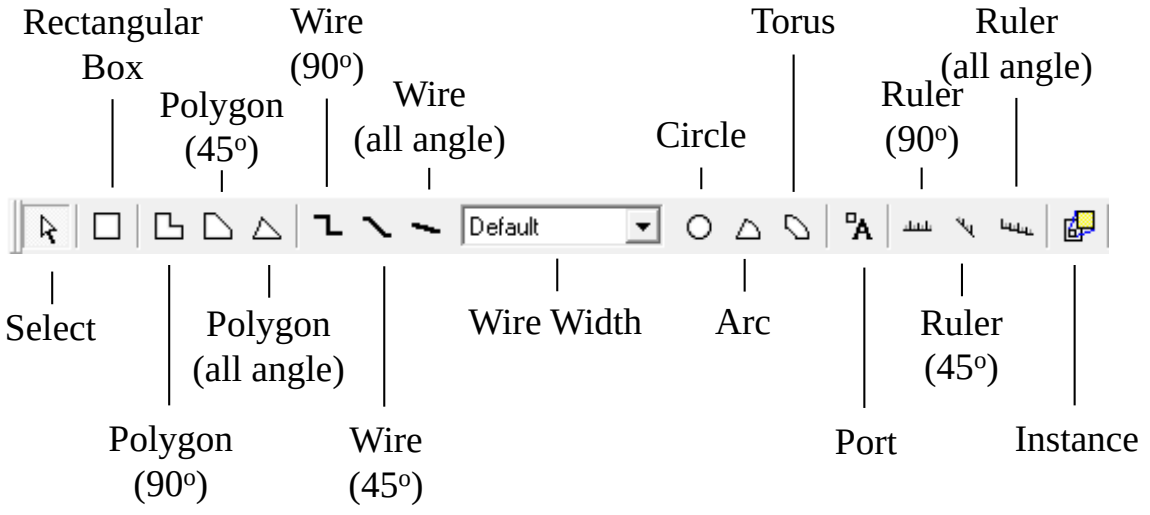
## L-Edit Toolbars



# L-Edit

## L-Edit Toolbars



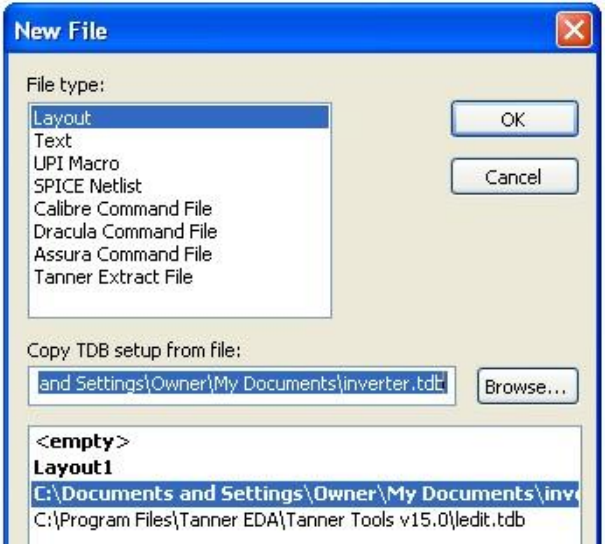
# L-Edit

## Setting Technology File

To set the technology file, follow the following steps:

From the Menu bar select Setup → File → New

In the New file window browse and set "Copy TDB setup from file:" to




C:\Documents and Settings\Owner\My Documents\Tanner EDA\Tanner Toolsv15.0\Process\MOSIS_Scalable_HP_500nm\MOSIS_Scalable_HP_500nmTech\mhp_n05.tdb

# L-Edit

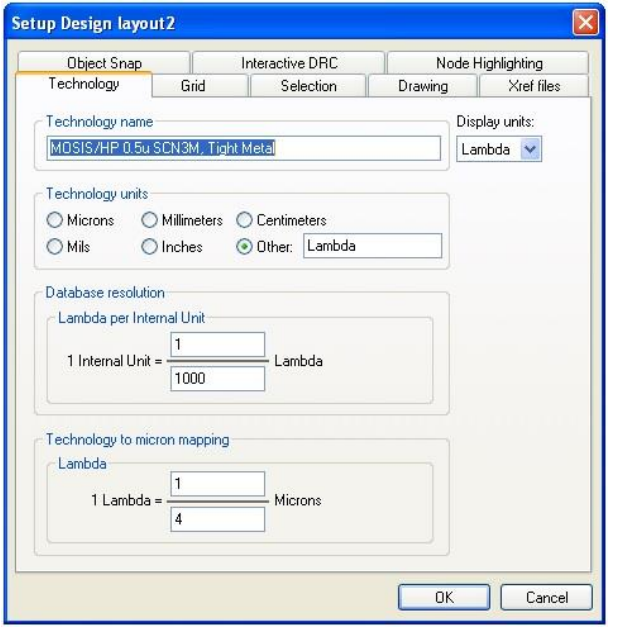
## Setting $\lambda$

To set a value for $\lambda$, follow the following steps:

From the Menu bar select Setup → Design → Technology

Under Technology/units: select "Other:" and keep the name as "Lambda"

Under Technology name: set the "Display units" as Lambda



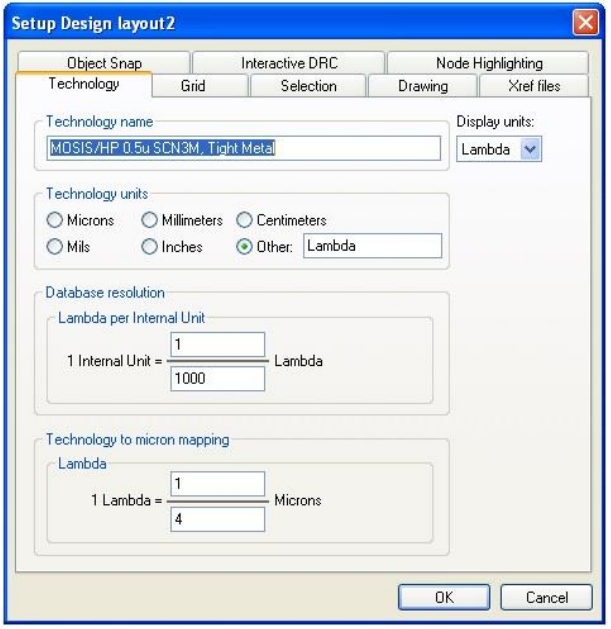
# L-Edit

## Setting $\lambda$

To set a value for $\lambda$, follow the following steps:

Under Lambda per Internal Unit: set the fraction to $1/1000$

Under Lambda: set the required value of $\lambda$ in terms of $\mu m$. (in our case it is $1/4$)



# L-Edit

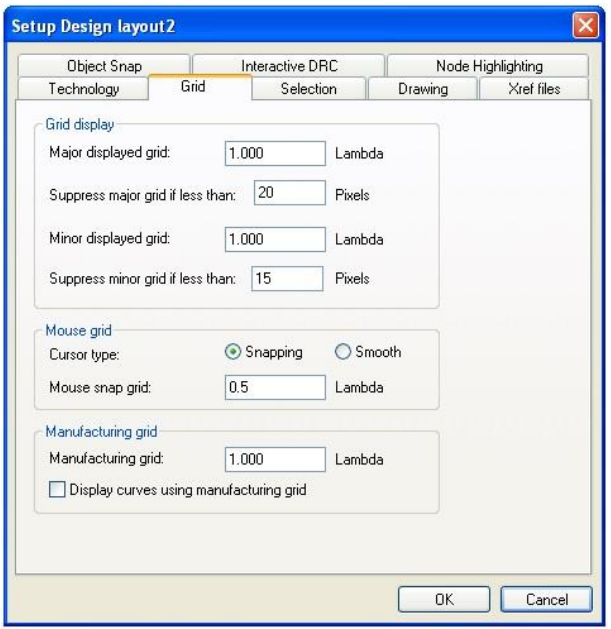
## Setting Grid

To set grid, follow the following steps:

From the Menu bar select Setup → Design → Grid

Under Grid display: set the ”Major Displayed grid” to 1.0 Lambda

Under Mouse grid: chose Snapping

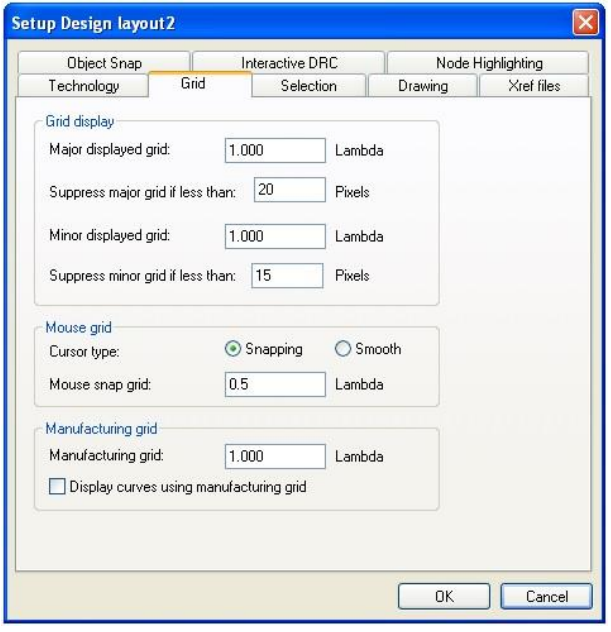


# L-Edit

## Setting Grid

To set grid, follow the following steps:

Under Mouse grid: set “Mouse snap grid” to 0.5 Lambda



# L-Edit

## Example

Draw the layout of a minimum size CMOS inverter