

Working with Files and Cells

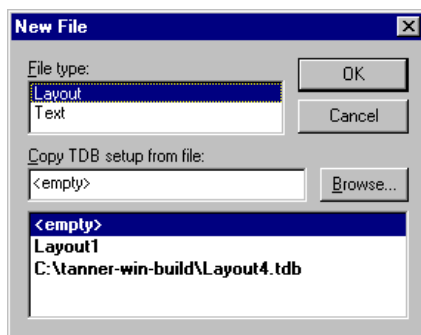
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Files

A complete L-Edit design is composed of cells contained in a design file. You can keep as many design files, with all their component cells, open simultaneously, limited only by your hardware. The name of a file appears in the L-Edit Title bar.

Creating Files

New files are created with the **File > New** command.



L-Edit will allow the user to open and create files of different types:

- Layout (or TDB) files.
- Text files.

When creating new layout files, the user will need to specify the setup file on which the new file is based.

In the **New File** dialog, you choose the new file type.

- If you select Layout type, the bottom part of the dialog will be enabled. You will be able to choose the source setup file by selecting one from the list of predefined setup files, by typing the name into the text field, or by browsing for the source setup file.
- If you select Text type, the bottom part of the dialog will be disabled.

The list of predefined setup files will contain:

- [1] <empty> — this is a standard empty setup (this is the default setup with black background, single layer and no DRC rules).
- [2] The list of currently loaded TDB files (displayed in bold face).
- [3] The list of TDB setup files found in the predefined setup directories. In the **Setup Application** dialog, you can specify the TDB setup directories.

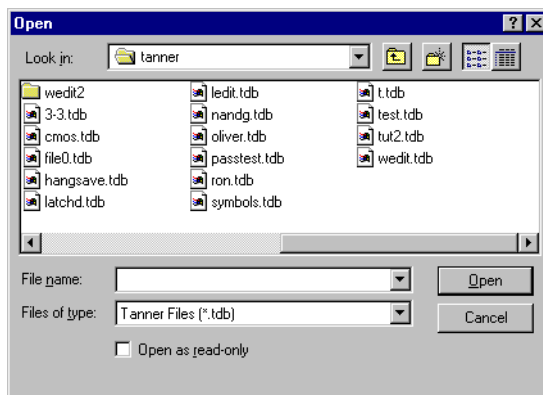
When you create a new file, the name of the file will be followed by a number, e.g., **Text2** or **Layout5**, depending on the history of the current session. When

you try to save the new file, you will be prompted to change the filename, if needed.

After the file is created, you will be able to specify the values of **Author** and **Organization** fields through **File > Info** dialog.

Opening Files

Existing files are opened with the **File > Open** command.



Enter the name of the file under **File Name**, or **Browse** for it. You can open a:

- TDB file, including previous versions.
- Text file.

You can specify that a TDB file be opened as read-only.

Closing Files

The current file can be closed with the **File > Close** command. If any changes made to the file have not been saved, you will be prompted to save the changes.

- If **Yes** is clicked, then the **Save As** dialog appears (see Saving Files, below).
- If **No** is clicked, then unsaved changes are discarded and the file is closed.
- If **Cancel** is clicked, then the close operation is canceled.

Saving Files

The current file can be saved with the **File > Save** or **File > Save As** commands. The TDB file may be saved in version 7 format or in version 6 format.

- The **Save** command saves the contents of the current file under its previously saved name.
- The **Save As** command saves the file under a file name and type that you specify. The dialog presented by **Save As** is very similar to that presented by the **Open** command, displayed above (see [Opening Files](#)).

The following display settings describing the file will be saved:

- Size and location of all layout windows opened in this file.
- Which cells are open.
- The following viewing options:

Zoom levels of open cells.

Visibility of origin and grid.

Visibility of arrays and ports.

Last View options.

Visibility of objects and layers.

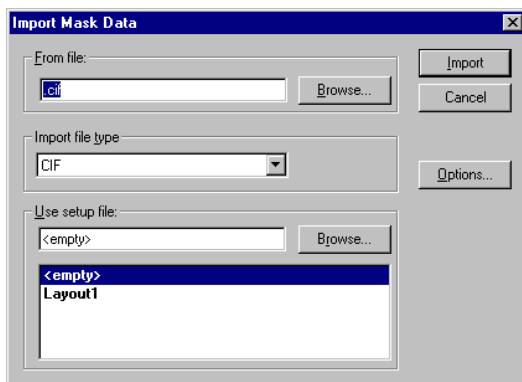
The grid size (both snap grid size and display grid size) are file settings and are saved in the TDB file.

Saving Text Files

When you want to save a text file, use the **Save As** and **Save** commands. If you have not given the text file a name, L-Edit will prompt you to give the file a name.

Importing Files

CIF or GDSII files are imported into L-Edit with the **File > Import Mask Data** command.



To import a CIF or GDSII file:

- Enter the name of the file under **From file**, or specify an existing path and file available using the **Browse** button.
- Specify the **Import file type** either **CIF** or **GDSII**. The **Options** button is enabled when you choose **CIF**. Clicking on **Options** opens a dialog with a

check box that allows you to read rectangular polygons as boxes. See [File > Import Mask Data](#) for more information.

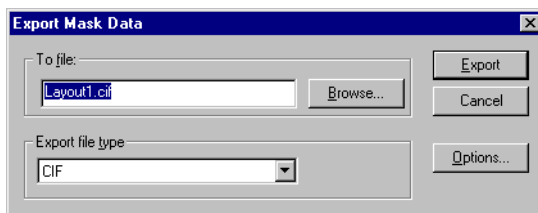
- Select a TDB setup file in the list box under **Use setup file** that will provide all necessary layer setup information. You can use the **Browse** button to find a setup file that is not listed.
- Click the **Import** button.

When importing a CIF or GDSII and you do not specify a setup, a dialog opens and specifies two options:

- Generate new layers for all unknown layers automatically.
- Place objects on all unknown layers to the Icon layer.

Exporting Files

CIF or GDSII files are exported from L-Edit with the **File > Export Mask Data** command.

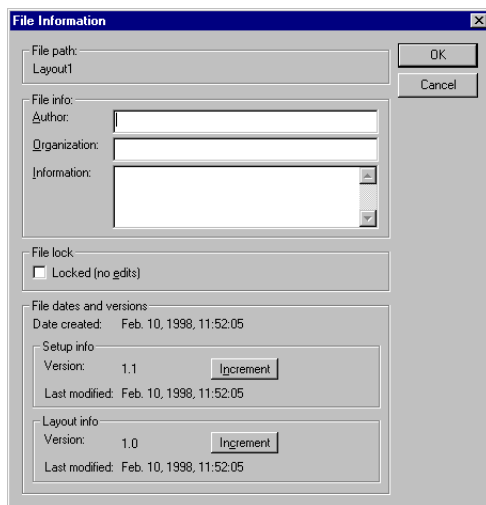


To export a CIF or GDSII file:

- Enter the name of the file to which you want to export mask data in **To File**, or specify an existing path and file using the **Browse** button.
- Specify the **Export file type**, either **CIF** or **GDSII**. The **Options** button displays a dialog where you specify further options, which vary according to the **Export file type**. For CIF files, the option is **Write port-boxes (Nonstandard)**. For GDS II files, the options are **Use default GDS II units**; **Convert all cell names to uppercase**; and **Write circles as x sided polygons**. For more information on these options, see **File > Export Setup**.
- Click the **Export** button.

Accessing File Information

Information about the current file can be accessed with the **File > Info** command.



The options for the **File Information** dialog are presented below.

File info

Spaces to enter the file's **Author**, the author's **Organization**, and comments up to 256 characters (**Information**). **Author** and **Organization** are inherited when new cells are created.

File lock

This switch toggles the file between locked and unlocked states. Locked files cannot be edited. However, data from the file can be copied to another file.

File dates & version

To increment either setup or layout major version numbers (left of the decimal point), click the appropriate **Increment** button. Minor numbers (right of the decimal point) are automatically incremented whenever layout or setup information is changed and the file saved.

Cells

The cell is the basic building block of the integrated circuit design.

You can open multiple views of a cell by reopening the same cell. L-Edit will display and update each view of the cell in a separate layout window. The name of a cell is found in its Title bar.

Design Hierarchy

Cells may contain two types of components:

- Primitives — geometrical objects created in the cell.
- Instances — references to other cells.

An *instancing* cell contains references to other cells.

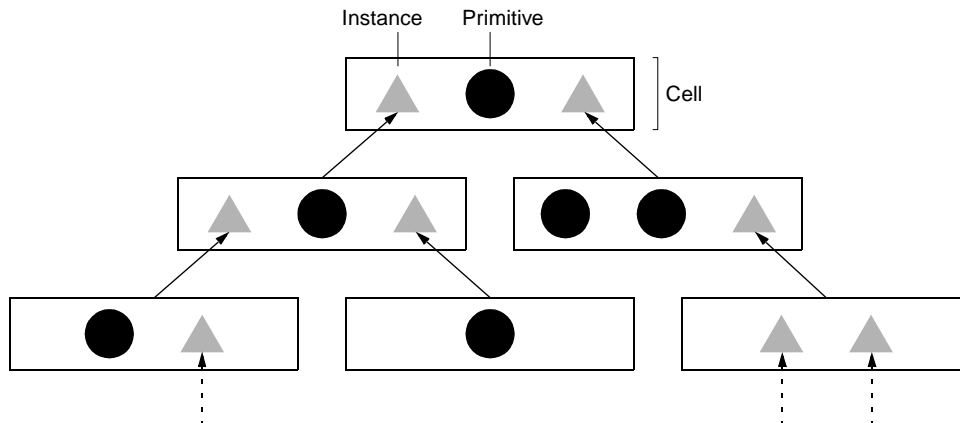
The *instanced* cell is the cell that serves as the template for the representation in another cell.

In an efficient design, cells, primitives, and instances form a tree-like hierarchical structure. The most elementary, cells reside near the “bottom” of the hierarchy; the subsystem cells, composed largely of instances, reside near the “top.” Actions

on a particular cell affect all of its instances in cells “above” it in the hierarchy.
The figure below is a design hierarchy:

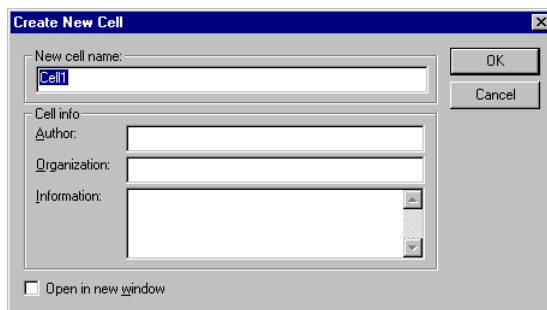
● = primitive

▲ = instance



Creating Cells

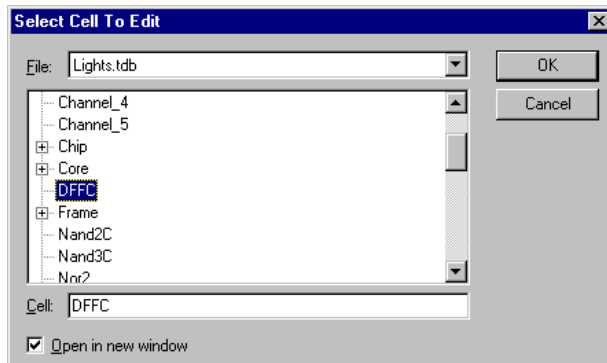
New cells are created with the **Cell > New** command.



You can enter a name of the new cell. You may enter other descriptive information as well. If the **Open in new window** option is checked, the selected cell will open in a new window and become the active cell. Otherwise, the cell will open in the current window.

Opening Cells

Existing cells are opened with the **Cell > Open** command.



The options are as follows.

File

The name of the current file (default) or of any other open file specified from the drop-down menu.

Cell list

The specified file's component cells are shown in the list. Highlight a cell by clicking its name in the list, and open the highlighted cell by clicking **OK**.

Double-clicking on a cell's name in the list also opens the cell.

Open in new window

If this option is checked, the selected cell will open in a new window and become the active cell.

If a cell's name is in bold, it indicates that the cell has been edited and that the changes have not yet been saved.

If an instance is selected in the Layout Area, then the cell it references is highlighted in the **Open Cell** dialog.

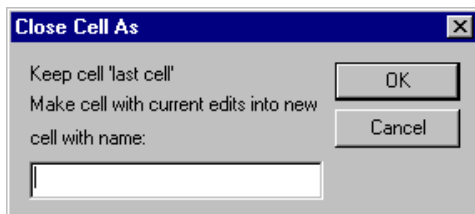
Cell names can be selected by typing in the **Cell** field. As you type letters in the **Cell** field, L-Edit automatically highlights the first name in the list beginning with the (case-insensitive) partial name being entered. For example, typing a **g** causes the first cell name beginning with **g** or **G** to be highlighted; adding a **u** highlights the first cell beginning with **gu**, **Gu**, **gU**, or **GU**; and so on.

Renaming Cells

The current cell can be renamed with the **Cell > Rename** or **Cell > Close As** commands.

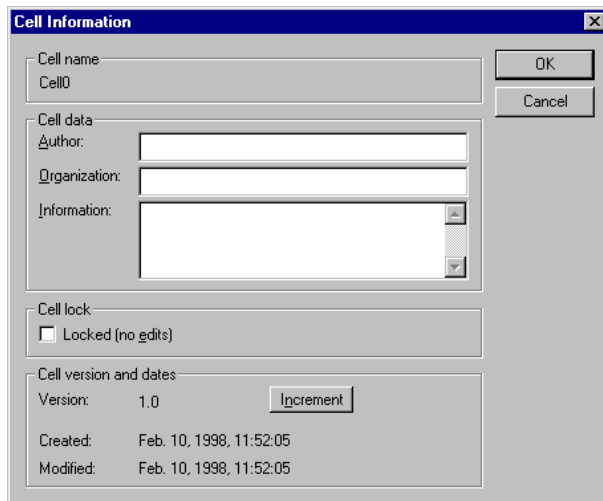
- **Cell > Rename** presents a dialog to rename the cell. When **OK** is clicked, the renamed cell stays open.
- **Close As** copies the cell — with revisions — to a cell with a new name. It closes the original without saving changes since the previous save operation and opens the copy.

The **Close Cell As** dialog is displayed below.



Accessing Cell Information

Descriptive information about the current cell can be accessed and edited with the **Cell > Info** command.



The image shows a 'Cell Information' dialog box with a blue title bar and a close button (X). The dialog is divided into several sections:

- Cell name:** A text field containing 'Cell0'. To the right are 'OK' and 'Cancel' buttons.
- Cell data:** A section containing three text fields: 'Author:', 'Organization:', and 'Information:'. The 'Information:' field is a larger text area with scrollbars.
- Cell lock:** A section with a checkbox labeled 'Locked (no edits)'. The checkbox is currently unchecked.
- Cell version and dates:** A section containing:
 - 'Version: 1.0' with an 'Increment' button next to it.
 - 'Created: Feb. 10, 1998, 11:52:05'
 - 'Modified: Feb. 10, 1998, 11:52:05'

The options for the **Cell Information** dialog are presented in the following table.

Cell data	Spaces to enter the cell's Author , the author's Organization , and arbitrary comments of up to 256 characters (Information). By default, the Author and Organization fields contain the text from the corresponding file info fields.
Cell lock	This switch toggles the cell between locked and unlocked states. Locked cells cannot be edited, but objects in them may be selected and copied to other cells.
Cell version and dates	The cell's creation and last modification dates.

Specifying the Fabrication Cell

One piece of information which must be supplied to your fabricator is the name of the cell which represents the top level of your design. If you do not specify this information, your fabricator will choose one for you, which might be the wrong cell.

Identifying the cell to fabricate tells L-Edit that when a CIF file is exported to tag the cell as such. The identified cell becomes the only top-level “cell” in the CIF file. (This feature is only available for CIF files. The GDS II format does not contain top-level cell information.)

Once a Fabrication Cell has been chosen, it will remain the Fabrication Cell until a new one is chosen, even if it ceases to be the top-level cell in your design. *Be sure to check the Fabrication Cell before writing a CIF file!*

Identify the cell to fabricate with the **Cell > Fabricate** command. The resulting dialog and the method of choosing the fabricate cell are very similar to the **Open** command (see [Opening Cells](#)).

Copying Cells

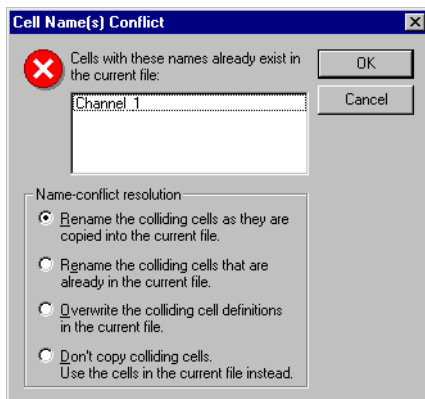
Cells may be copied within a file, or copied to the current file from other open files. When a cell is copied, a new cell (not an instance) is created, including all primitives and instances defined by the original cell. If a cell is copied from another file, all cell definitions of the instances in the copied cell are also copied. Since cells cannot have duplicate names, it may be necessary to rename the cell and possibly some or all of its instances.

Cells are copied with the **Cell > Copy** command. The resulting dialog and the method of choosing the cell to copy are very similar to the **Open** command (see [Opening Cells](#)).

To copy a cell from one file to another, both files must be open. The file that you want to copy the cell into must be the active file when you execute the **Cell > Copy** command. The **File** drop-down menu lists the open files from which you can choose a cell to copy.

If the cell being copied resides within the current file, then a new name is required. (The original cell name is not permitted. *You must rename the copy.*)

If the cell being copied resides in a *different* file, then the copy proceeds automatically unless a name conflict is detected. When a name conflict is detected, a warning is displayed, asking you to select one of four options required to complete the copy.



The options are as follows.

Rename the colliding cells being copied as they are copied into the current file.

(default)

Cells being copied from the *source* file, and causing name conflict, are renamed.

Rename the colliding cells that are already in the current file.

Cells residing in the current (*destination*) file, and causing name conflict, are renamed.

Overwrite the colliding cell definitions in the current file.

Cells in the current file causing name conflict are overwritten by the copied cells.

Don't copy colliding cells. Use the cells in the current file instead.

Source cells causing name conflict are not copied.

Reverting Cells

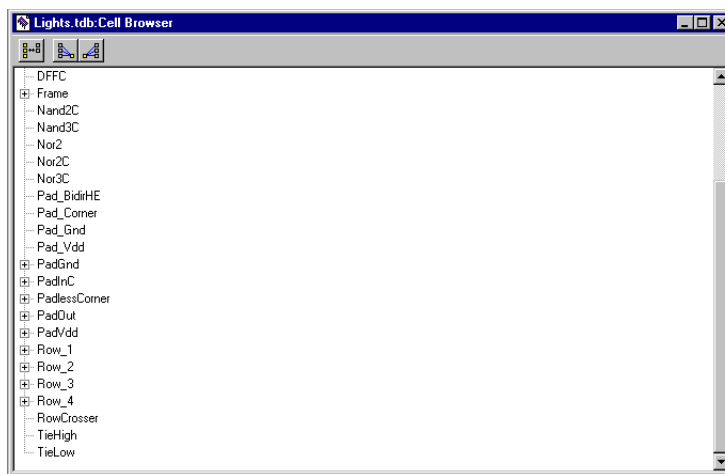
The **Cell > Revert Cell** command reverses all changes made to the current cell since the last time the file was saved. The discarded changes cannot be reversed using the **Undo** command.

Cell Browser

The **View > Cell Browser** command allows you to display and browse the hierarchy of cells in a TDB file. The Cell Browser can also be opened through the Cell Browser button on the Shortcut toolbar.

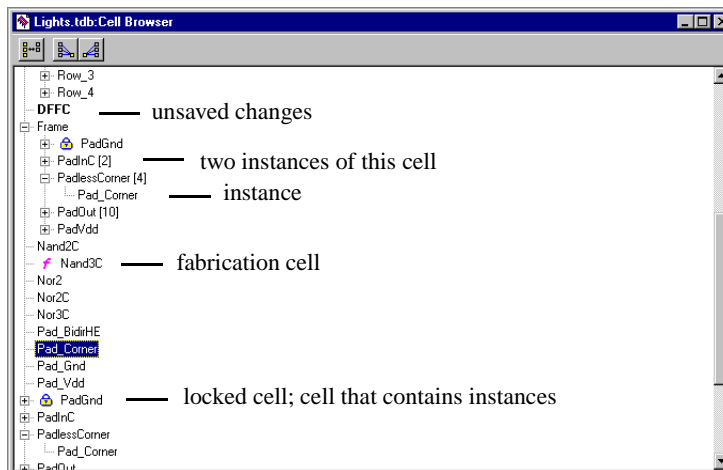
When the Cell Browser window is opened, the hierarchy tree is displayed in a fully collapsed state, showing only the top level.

There is only one cell browser for each TDB file.



Each branch of the hierarchy tree in the Cell Browser window corresponds to a cell, or instantiated cell.

If a cell contains instances, the instantiated cells are displayed on the sub-levels of the outline, as in the figure on the next page. If there is more than one instance of a cell contained within another cell, the number of instances will be displayed in brackets after the name.



Cells in a level are sorted alphabetically. If a cell contains instances, it has a “+” or “-” icon displayed next to it. A “+” icon indicates a collapsed state of the

outline, and a “–” icon indicates an expanded state of the outline. You can collapse or expand the outline by clicking on the “+” and “–” icons. Expanding the outline displays the cell hierarchy.

Additional Information in the Cell Browser

In addition to displaying the cell hierarchy for a TDB file, additional information is provided in the Cell Browser window.

- Unsaved changes in a cell are indicated by displaying the cell name in bold style.
- A lock icon will be displayed next to a cell’s name if a cell is locked for edits.
- A fabricate icon will be displayed next to a fabrication cell.
- If the cell is both locked and selected for fabrication, the fabricate and lock icons are displayed as one icon.

All Cells and Non-instanced Cells Display Modes

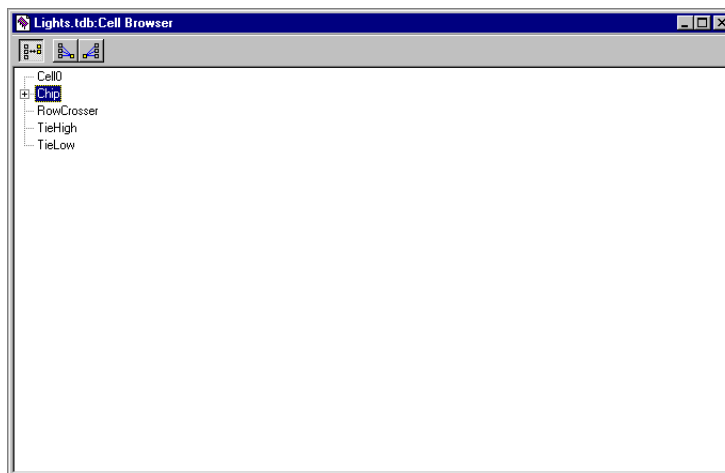
The Cell Browser supports two display modes: All Cells and Non-Instanced Cells.

- Non-Instanced Cells — only cells not instanced in any other cells are displayed in the Cell Browser.

- All Cells — All cells are displayed whether or not they have been instantiated.

The user can toggle the mode using the All Cells/Non-Instantiated Cells button in the toolbar of the Cell Browser.

The Cell Browser in Non-Instantiated Cells mode is displayed below.



Cell Browser Toolbar

The Cell Browser toolbar has:

- An All Cells/Non-Instanced Cells button that toggles the mode of the browser.
- Expand All and Collapse All buttons, which allow easy manipulation of the tree's state.

Performing Operations on Cells

When the cell browser is the active window, you are able to perform the actions that do not require the presence of the layout window.

For example, all of the functions from the **File** and **Setup** menus are available. Functions under **Tools** and the **Edit** functions are unavailable. Most of the functions from the **Cell** menu will be available, except **Instance**, **Revert** and **Close As**.

You can copy and instance cells to another file directly from the Cell Browser through drag and drop operations.

Drag and drop a cell from:***Result***

The Cell Browser onto the layout of the same file.

Creates an instance of the cell.

The Cell Browser onto the Cell Browser of another file.

Creates a copy of the cell in the other file.

From the Cell Browser onto layout of another file.

Presents a choice to instance or create a copy of the cell.

To simplify execution of certain functions available when the Browser is active, some of these functions are accessible through a context-sensitive menu that is activated with a click of the right mouse button once a cell is highlighted.

Functions executed through the context-sensitive menu operate on the selected cell.

Open	O
New	N
Rename	T
Delete	B
Hierarchical Delete	
Flatten...	
Fabricate	
Info...	

Following are a list of the parameters.

Open	Selected cell opens by double clicking on its icon in the cell hierarchy or by selecting Open .
New	Creates new cell in the current TDB file.
Rename	Renaming in place for selected cell.
Delete	Deletes selected cell.
Hierarchical Delete	Deletes a cell with all cells instanced in it, as long as instanced cells are not instanced in other cells in the file.

Flatten	Flatten selected cell.
Fabricate	Mark fabrication cell.
Info	Display information dialog for the selected cell.

Depending on the state of the selected cell, parent cell and parent file, some menu items will be disabled. The disabled menu items and their associated conditions are listed below.

Condition

Disabled Items

File is locked.

All items except for **Open**, **Info**.

Selected cell is
instanced somewhere.

Delete, **Hierarchical Delete**.

Selected cell is locked
for edits.

Flatten, **Rename**, **Delete**, **Hierarchical Delete**.

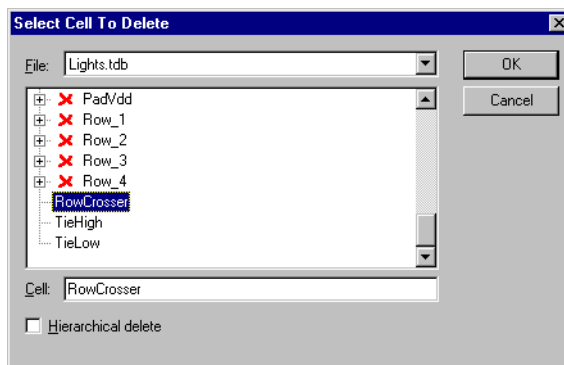
Printing

You can print the cell hierarchy when the cell hierarchy view is the active window. The hierarchy will be printed in its current state, using “+” and “-” to indicate the state of the branches. Each level of the cell hierarchy will be shifted from the previous one to the right by three characters.

Information that the cell is locked or selected for fabrication will be displayed in brackets after the cell name, in the form [Locked] [Fabricate].

Delete and Hierarchical Delete

You delete a cell with the **Cell > Delete** command. The **Select Cell To Delete** dialog is displayed below.



Select the file in which you want a cell deleted from the open files. Highlight the cell that you want to delete. It must not have a red **x** next to it. Cells marked with a red **x** cannot be deleted.

There is a **Hierarchical delete** check box in the **Select cell to delete** dialog. This check box allows you to choose between a regular and a hierarchical delete.

When you choose a hierarchical delete, the selected cell will be deleted together with all cells instanced in it, as long as these cells are not instanced in other cells in the file.



Instances

An *instance* is a representation of a cell in a particular location and orientation in another cell.

Even if many instances of a cell occur in a design, changes made to that cell will be automatically reflected in all instances of that cell.

Layouts involving instances consume less memory than “flat” designs where all the features exist as originally drawn objects.

An *array* is a two-dimensional arrangement of instances, offset in the vertical and/or horizontal directions by specified amounts. A single instance is equivalent to a 1x1 array.

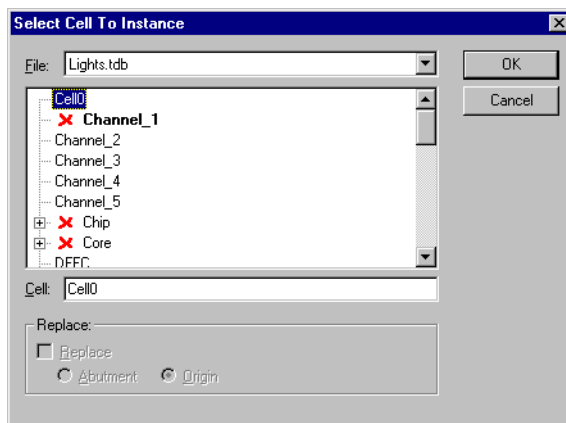
To create an array of an instance, select the instance and invoke **Edit Object(s)**. On the Instance tab, enter the horizontal and vertical array repeat count and the X and Y spacing between array elements. (See **Edit > Edit Object(s)** for more information on array parameters). Also an array can be created by grouping instances, see [Grouping and Ungrouping](#) for more information).

There are three options to create an instance of another cell in the current cell. One options is to drag and drop from the Cell Browser. For more information on this option, see [Performing Operations on Cells](#).

The other two options are:

- The **Cell > Instance** command.
- Click on the instance icon in the Drawing toolbar.

For each of these options, the **Select Cell To Instance** dialog opens. It is displayed below.



The options for the **Select Cell To Instance** dialog follow.

File	The name of the current file (default) or of any other open file specified from the drop-down list.
Cell	The specified file's component cells are shown in the list. Highlight a cell by clicking its name in the list, and instance the highlighted cell by clicking OK .
Replace	When the Replace check box is checked, the instance selected in the Layout Area is replaced by an instance of the cell selected in the dialog.

Bold font indicates that the cell has been edited, and that the changes have not yet been saved.

With the search feature, cell names can be selected by typing instead of scrolling and clicking. As you type letters in the **Cell** text field, L-Edit automatically selects the first name in the list beginning with the (case-insensitive) pattern being entered.

For example, typing a **g** causes the first cell name beginning with **g** or **G** to be highlighted; adding a **u** highlights the first cell beginning with **gu**, **Gu**, **gU**, or **GU**; and so on.

There are two conditions where a cell cannot be instanced.

- A cell cannot instance itself, even indirectly.
- L-Edit will not allow a cell from another design file with a different technology (layer setup) to be instanced.

If the paste-to-cursor option is on and an instance is created, then the instance moves with the pointer until a mouse button is clicked. The instance is dropped into place.

When the **Replace** check box is checked, the instance selected in the Layout Area is replaced by an instance of the cell highlighted in the dialog.

The **Abutment** and **Origin** radio buttons become active when **Replace** is checked. These buttons indicate whether the replacement location is determined by Abut ports or by origins.

An *Abut port* is a port with text that matches the **Abutment** field in the **SPR Core Setup** dialog (which appears with the **Setup > SPR > Core setup** command). If **Abutment** is selected, and the Abut ports in the cell to be replaced and the replacing cell do not match, or there are no Abut ports in either cell, then a warning dialog asks if the center of instances should be used instead. The check of Abut port names is case sensitive.

Editing Instances and Arrays

An instance cannot be resized, reshaped, sliced, or merged, and vertices and edges cannot be individually edited. However, the instance as a whole can be:

- Moved.
- Arranged with the **Rotate** and **Flip** commands.
- Text-edited (for example, to increase the array size) by double-clicking it with the **Move-Edit** button *or* by selecting it and using the **Edit Object** command. Textual editing of instance/array objects is discussed in [Instances](#).

The contents of an instance or array may be edited in two ways:

- Returning to the original cell and making the desired changes there.
- Using the *edit-in-place* feature (see [Editing In-Place](#)).

Changes made in the original cell are automatically updated in all instances and arrays of that cell.

Editing In-Place

You can edit an instance, a cell that is represented in another cell, without using the **Open** command. This is called editing in-place. Editing in-place is not possible for instances that have been rotated by non-orthogonal angles.

To edit an instance in-place:

- Select the instance to be edited.
- To “step down” into the instance: use the **Edit > Edit In-Place > Push Into** command; press the **PgDn** key, or the **Edit In-Place > Push Into** button on the Standard toolbar (see [Standard Toolbar](#)).
- You may now edit the contents of the instance as if you had in fact opened the original cell.

While you are in a given instance, you may only select or edit objects contained in that instance. This includes regular geometry as well as other instances or arrays.

You may continue to step down into instances by selecting them and then using one of the “step down” option described above.

To step up in the hierarchy (or end the edit-in-place session), press the **PgUp** key successively until you return to the top cell.

When you are editing in-place, you can use the **Edit > Edit In-Place > View Top Cell** command to change the view to the home view of the top cell.

Flattening Instances and Arrays

The **Cell > Flatten** command removes the hierarchy of a cell. This is done by replacing all instances with the objects from the cell that they reference. The effects of this command *cannot* be reversed using the **Undo** command.

To flatten an instance by one level, select it and use the **Draw > Ungroup** command. This command can be undone.

Grouping and Ungrouping

The **Draw > Group** command creates a cell containing the currently selected objects and then creates an instance of that cell in the current cell.

The **Draw > Ungroup** command reverses the effects of the **Group** command. It “flattens” the instance, ending its relationship with its original cell. The contents of the instance are placed into the cell being edited, in the proper position and orientation (even after rotation).

Ungroup does not delete the cell created by **Group**.

The **Group** and **Ungroup** commands can also be used to create or remove arrays from existing, identical, and properly spaced instances.

Group can be used to form an array of existing identical instances, under certain conditions. The selected instances must be:

- Of the same cell.
- Have no repeat values.
- Have the same *orthogonal* transformations and regular translations. (Nonorthogonally rotated instances cannot be grouped.)

In other words, **Group** can transform a collection of instances that already have the appearance and spacing of an array into a single object that L-Edit recognizes as an array. If these conditions are met, then an array is automatically formed. If not, then a dialog exactly analogous to the one presented by the **Group** command appears, asking for the name of the new cell to be created from the selected objects.

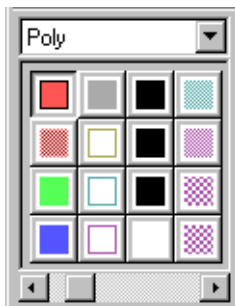
Both **Group** and **Ungroup** can be reversed with the **Undo** command.

- Executing **Undo** immediately after **Ungroup** results in the selected objects being grouped again, as if the **Group** command had just been used for the first time.
- Executing **Undo** immediately after **Group**, however, is not a complete reversal of **Group**. The cell created by **Group** is not deleted.

Layers

Layer List

An L-Edit setup contains an ordered list of layers, shown as icons in the Layer Palette.



The order of the layer list in the Layer Palette is from top to bottom and left to right: the layer at the top of a column in the Layer Palette is followed by the layer immediately below it, and so on; the layer at the bottom of the column is followed by the layer at the top of the next column to the right.

Pass Lists

Each layer contains drawing information in the form of three sets of passes, which determine how items are drawn on the screen.

- *Object* passes are used to render all objects (boxes, circles, and so on) except ports.
- *Port* passes are used to render ports independently, so that a rendering plan may be designed to make ports visible, even when they are coincident with other objects on the same layer.
- *Text* passes are used to render text, such as the labels attached to ports and ruler text.

There is in addition a *select* pass to render objects on a layer when they are selected.

Pass Attributes

Each pass set, or list, is made of one or more passes. Each pass has three attributes:

- The *color* is one of the 16 in the color palette.
- The *stipple* is the pattern used to fill objects during that pass.

- The *write mode* determines the appearance of regions of overlap. The write mode may be either **Set** or **Clear**.

Pass Types

The minimum number of passes in a list is two: one *select* pass and at least one *draw* pass.

The draw passes are labeled sequentially (1, 2, ...). L-Edit uses the draw passes in order: it draws pass 1 of layer 1, then pass 1 of layer 2, and so on, through all of the layers. Then it starts over, drawing pass 2 of layer 1, pass 2 of layer 2, and so on. It is possible to arrange the layer list and the pass lists to achieve any desired ordering of filled and outlined layers in various patterns and colors.

The select pass determines the appearance of the corresponding items when they are “selected” on that layer. If a layer’s draw passes have the same color as the background, then objects on that layer will be invisible. *However, they still exist and will be fabricated!*

Changing the Select Pass for a Layer

For example, draw an object on the Active layer in the file **morbn20.tdb** and select it. The selected object has a black outline. When the object is deselected, the black outline disappears. To change the select pass of the Active layer:

- Click the Active layer icon in the Layer Palette.

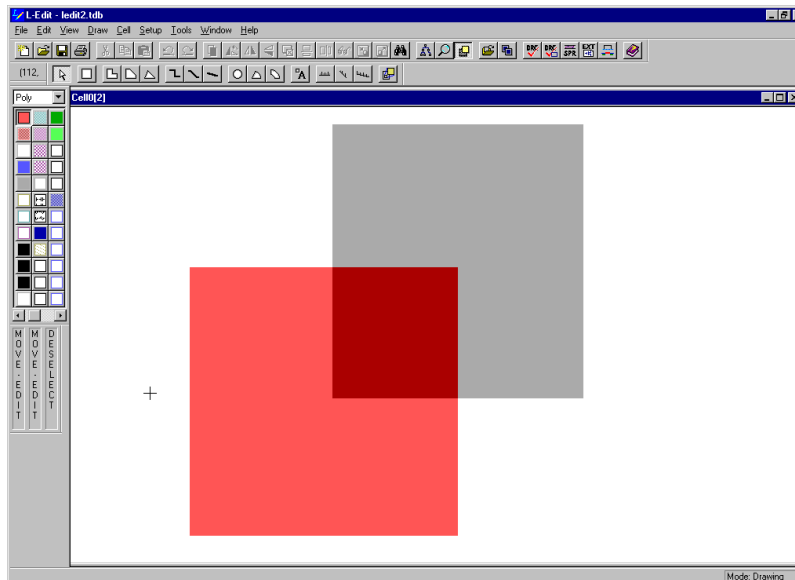
- Use the **Setup > Layers > Rendering** command. A dialog appears.
- Click the select pass, marked **SEL**, in the pass list.
- In the **Stipple** section, click one of the small pattern buttons; the large box is filled with the chosen predefined pattern (stipple). Changes are saved by clicking **OK**.

Now, if the Active object drawn earlier is selected, the newly chosen stipple, rather than the default black outline, indicates that the object is selected.

Set and Clear Modes

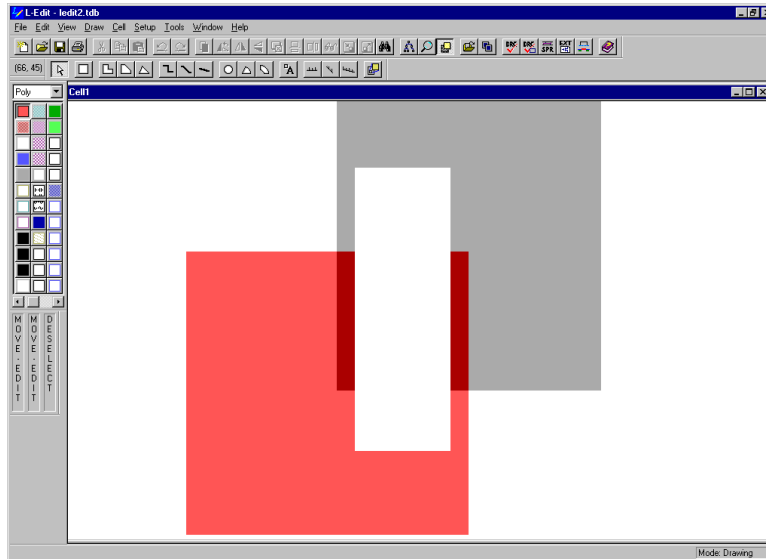
A layer's appearance is the result of two or more separate passes that are combined when objects on the layer are drawn. The passes of overlapping objects are also added in the region of overlap to produce entirely new colors and patterns. This additive mechanism ensures that regions of overlap are displayed in a meaningful way without obscuring the presence of other objects.

In **Set** mode, the color of regions of overlap is determined by a logical OR between the colors' codes. Objects thus seem to intersect ("set") each other. The figure below shows two overlapping boxes, one on the Metal1 layer, the other on the Metal2 layer. The region of overlap is a third, darker color. This is because the color used by Metal1 is 1000, the color used by Metal2 is 0001, and the logical OR of the two is 1001. The color palette would reveal that color 1001 is the one taken by the region of overlap.



In **Clear** mode, the color of regions of overlap is determined by a logical AND between (1) the complement of the color of the more recently drawn pass (e.g., 1st, 2nd, 3rd) and (2) the color of the less recently drawn. More recently drawn objects overlay ("clear") less recently drawn objects.

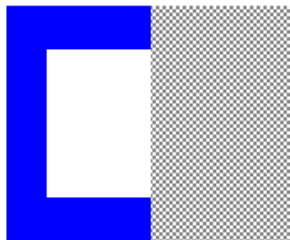
The figure on the next page shows a box on the Via layer which overlaps both of the boxes from the example in the figure above. This third box has the same color everywhere, even where it overlaps the other boxes. This is because its color is 1111; the complement of 1111 is 0000; the logical AND of 0000 and any other color is still 0000, so the drawn color is always 0000.



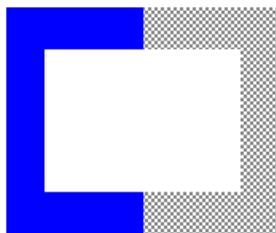
Sometimes a “null” pass is inserted into a layer’s pass list as a place holder. This pass has color 0000 and Set mode. A “null” pass thus has no direct effect on the appearance of an object, because the product of a logical OR of 0000 with any other color is the other color.

These “null” passes are used because of the order in which L-Edit draws passes. A “null” pass inserted into the pass list raises the other passes up one pass. For example, the Via layer has one Clear mode object pass with color 1111. This pass “clears” colors underneath Via objects, but has no effect on the appearance of objects on layers following Via.

The figure below shows a box on Via; it is overlapping boxes on layers Metall and Overglass. (Metall precedes Via in the layer list, and Overglass follows it.) The overlap between Via and Overglass is not visible. A “null” pass inserted in *Via*’s pass list raises the Clear mode pass to pass 2; Via now has the same effect on all objects.



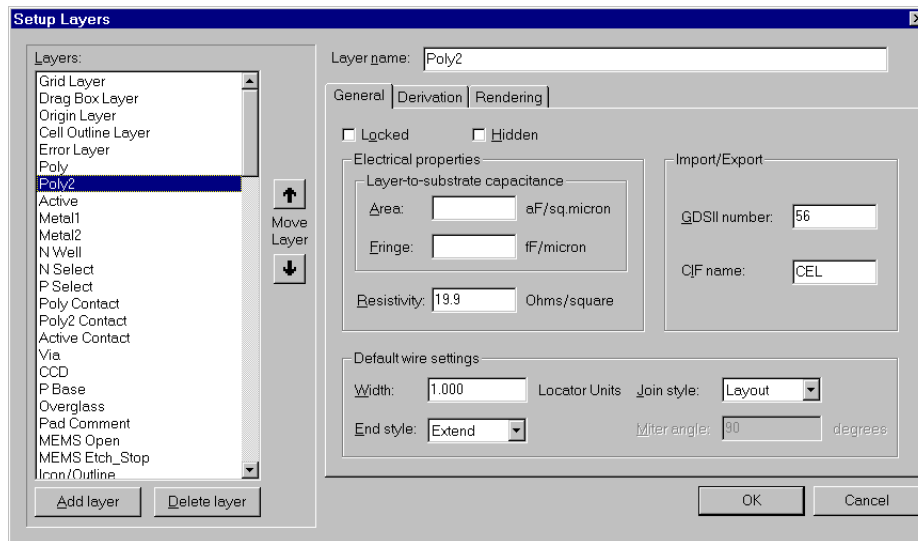
The figure below shows the same three boxes, but here Via has 2 object passes. Pass 1 is a “null” Set mode pass with color 0000, and pass 2 is a Clear pass with color 1111.



In actuality, it is not a simple task to design a rendering scheme which effectively combines the palette, layers, passes, colors, and stipples. For example, if the colors 1110 and 0001 are the same, and in the example above, if Metal2 had used 1110 instead of 0001, the results would have been different.

Layer Setup

The **Setup > Layers** command allows you to edit the layer structure in the current file. The **Setup Layers** dialog is shown below.



The list of layers as well as the **Add layer**, **Delete layer** and **Move Layer** buttons appear on the left side of the dialog.

You can select a layer from the list box in the left side of the dialog. When you select a layer, information concerning it will be available in the right side of the dialog.

To add a layer, click **Add layer**. A new layer is inserted in the layer list after the specified layer, moving all following layers down one position in the list. Two layers may not have the same name.

When you create a new layer, L-Edit assigns a default name. You can rename a layer by typing in a new name in the **Layer name** text field.

To delete the specified layer, click **Delete layer**. The specified layer is deleted from the layer list, moving all following layers up one position in the list. At least one mask layer must exist at all times. L-Edit will prevent the last mask layer from being deleted.

You can change the order of layers in the **Layers** list by using the Up and Down buttons. A generated layer cannot be placed above the source layers used to generate it.

There are three tabs in **Setup Layers** dialog: **General**, **Derivation**, and **Rendering**.

Setup Layers—General

This tab, shown in the previous figure, allows you to set the following properties:

Electrical properties

Specify values for the **Layer-to-substrate Area** and **Fringe capacitance** (capacitance between the specified layer and the substrate). Also specify the **Resistivity** (resistance per unit area of the specified layer). This information should be available from your chip foundry.

Import/Export

The GDSII number and the CIF name.

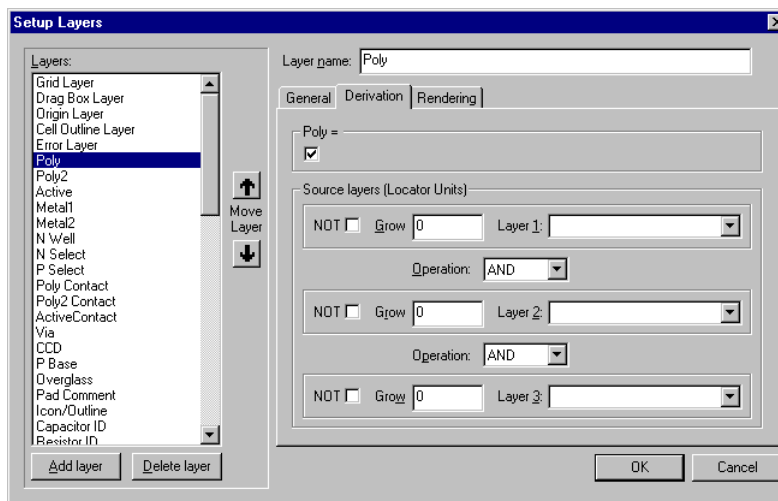
Default wire settings

Specify the following wire setting: width, end style, join style, and miter angle. These are the settings for wires on the specified layer.

Setup Layers—Derivation

This tab option, shown in the figure below, allows you to develop a generated layer based on existing layers. The new layer name must be inserted in the layer list *after* the names of the layers which are involved in its creation.

For example, if you define a Gate layer as Poly AND Active, then Gate must come after Poly and Active in the layer list. Any previously listed layer, even previously generated layers, may be used in the definition of a generated layer.



To insert a new generated layer:

- Click **Add layer**.
- Type in the layer name in the **Layer name** text field.

- Designate the source layers and their properties.

The options used in designating the source layers follow.

Source layers

Select these from the drop-down menus under **Layer 1**, **Layer 2**, or **Layer 3**. Only layers that appear *before* the target layer in the layer list can be selected as source layers.

NOT ... GROW

Each source layer has an associated **NOT** switch. Turning this switch on specifies a NOT operation on the source layer. Each source layer also has a **GROW** field (the integer, in Locator Units, by which objects on the source layer are grown or shrunk). If the integer is positive, objects grow by that amount. If negative, they shrink by that amount.

AND ... OR

Between the first and second, and second and third, source layers are drop-down lists to specify pairwise operations. For example, if your first two layers are *Poly* and *Active*, selecting the **AND** button between them results in **Poly & Active**.

See [Generate Layers](#) for more information.

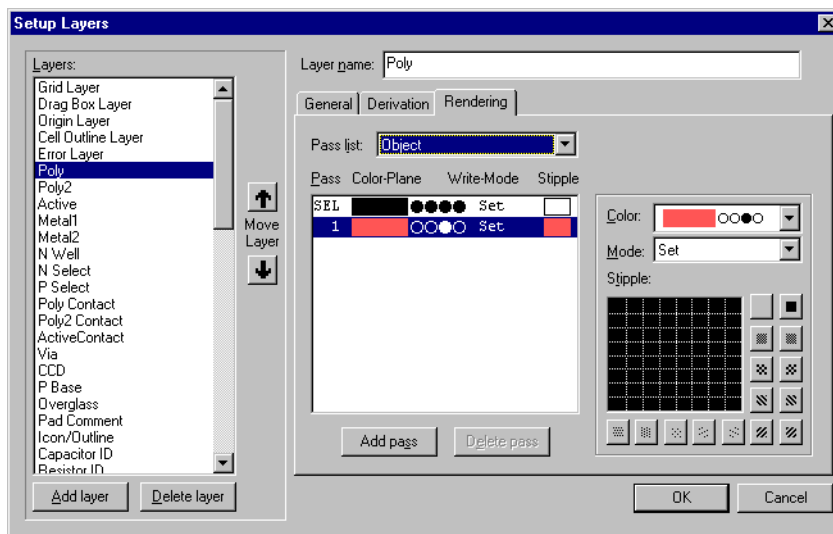
Enabling Generated Layer

There is a check box in the **Derivation** tab that when checked enables or disables the derivation of a generated layer. This is a convenient way to activate or deactivate a particular generated layer without changing other setup information.



Setup Layers—Rendering

The **Rendering** tab has a number of options.



The parameters for the **Rendering** tab follow.

Object • Port • Text

The pass lists are edited one at a time.

Pass list (Pass, Color-Pane, Write-Mode, Stipple)

The label **SEL** indicates the select pass. Other passes are numbered sequentially (**1, 2, ...**). Clicking a pass entry highlights it for editing.

Add pass • Delete pass

Passes can be added to or deleted from the pass list.

Color

The pass's color is chosen by clicking the appropriate sample bar in the palette. Changes made here are immediately reflected in the **Pass list**.

Mode

Either **Set** or **Clear** (see [Set and Clear Modes](#)). Changes made here are immediately reflected in the **Pass list**.

Stipple

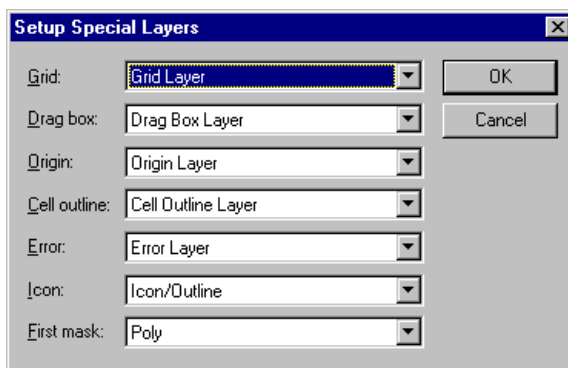
The stipple (display pattern) for the pass can be drawn or chosen from among the fifteen available patterns displayed around the 8x8 grid (the *stipple edit box*). Clicking one of the predefined patterns displays it in the stipple edit box and enters it in the **Pass list**.

Stipple (continued)

The stipple edit box can be used to create customized stipples. Each square in the grid represents a single screen pixel. Individual squares (pixels) can be toggled on and off by clicking the **Choose** mouse button when the pointer is in the square. Dragging the pointer across a group of squares toggles all their states. Changes made are immediately reflected in the **Pass list**.

Special Layers Setup

“Special” layers control the appearance of various L-Edit constructs: grid, origin, drag boxes, and so on. They are treated just like other layers: the **Setup > Layers** command may be used to define them, objects may be drawn on them, and design rules may be specified for them. In fact, they may be identical to layers used for other purposes (for example, Poly can be designated as the “Grid” layer). Special layers are designated with the **Setup > Special Layers** command. The appropriate layer is chosen from the drop-down menu next to each field.



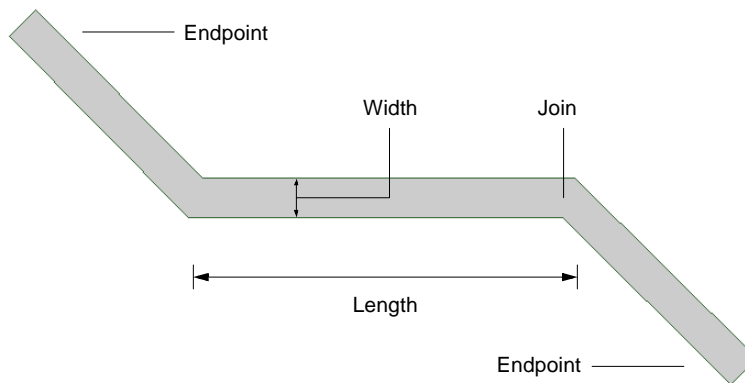
The following parameters are found in the **Setup Special Layers** dialog.

Grid	The layer on which the displayed grid points are drawn.
Drag box	The layer on which the boxes displayed during a drag operation are drawn and on which the nibbling wire is drawn.
Origin	The layer on which the origin crosshair marker is drawn.
Cell outline	The layer on which instanced cell outlines are drawn.
Error	The layer on which DRC and SPR error markers are drawn.
Icon	The layer on which non-fabricating comment items are drawn.
First mask	The layer in the top leftmost corner of the Layer Palette.

Wire Styles

Wire Terminology

An L-Edit wire consists of one or more rectangular segments joined at common ends. All segments in the wire have the same width, but each segment can have a different length. The point where two segments meet is called a *join*. The *endpoints* of a wire are the two segment ends which are not involved in joins.



A wire is characterized by a *style*, consisting of three properties:

- *Width* (in locator units — *different* from the “width” reported in the Status bar when a wire is selected).
- *End style* (the appearance of the wire’s endpoints).
- *Join style* (the appearance of the wire’s joins).

The “width” reported in the Status bar when a wire is selected is the *x*-width of the minimum bounding box of the whole wire, not the “width” indicated in the figure on the previous page.

End Styles and Join Styles

L-Edit recognizes three end styles and four join styles. These styles describe the *visible* ends and joins of wires. Changing a wire’s style does not affect its endpoint or vertex coordinates.

Following are the different end and join styles.

End styles

Butt	Flush with the endpoint.
Round	“Capped” with a half-circle whose diameter equals the wire width.
Extend	Extended past the endpoint for a distance equal to half the wire width.

Join styles

Layout

The adjoining segment ends are extended to a distance equal to half the wire width. The resulting gap is filled with a triangle. This is the default join style.

This join style corresponds most closely to the interpretation of wires used by most fabricators. We recommend using this join style exclusively in your designs. (Wires created in versions of L-Edit previous to version 5 are automatically converted to the join layout style.)

Round

The adjoining segment ends take on the round style.

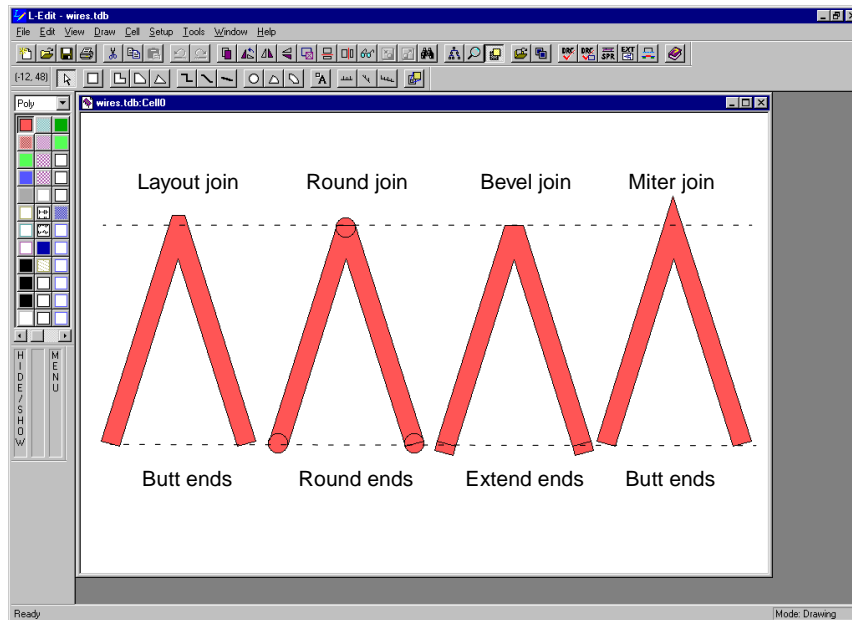
Bevel

The adjoining segment ends take on the butt style. The resulting gap is filled with a triangle.

Miter

The adjoining segment ends are extended until their outer edges meet. If the angle between the two segments is less than the user-specified *miter angle*, a bevel join is used instead.

The figure below illustrates various end and join styles.



The end style and join style affect the appearance of wires on the screen only. Contact your fabricator to determine the actual method of fabricating wires and what end and join styles the fabricator supports.

It is critical to verify that your fabricator interprets wires in the same manner as your layout. Otherwise the actual chip fabricated may be very different from what you wanted.

Wire Style Defaults

When a wire is first created, its style is taken from the default setting for the layer on which the wire is drawn, specified with the **Setup > Layers** command. You may change the wire style parameters in the **Default wire setting** area in the **Setup Layers** dialog.

Before you draw wires for the first time, or if you are setting up technology files for others who may use wires, set the wire defaults for each layer according to whether your likely output format will be CIF or GDS II.

For CIF, use wires with the *extend* end style and the *layout* join style.

For GDSII, allowable combinations of end and join styles are shown in the table below. All other combinations of end and join styles will produce an error message when exporting to a GDSII file.

<i>End style</i>	<i>Join style</i>
Butt	Layout
Round	Round

*End style**Join style*

Extend

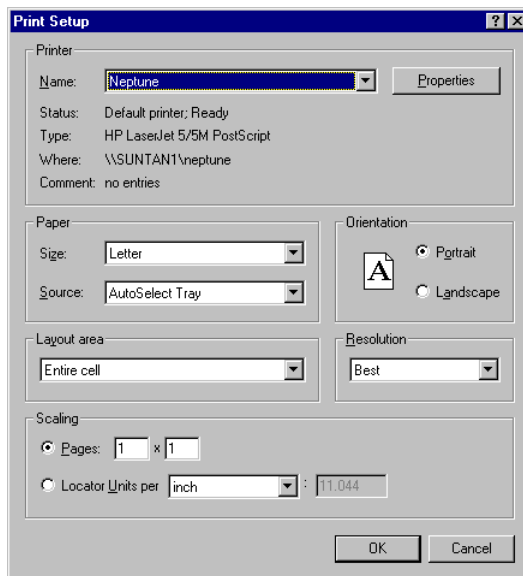
Layout

After a wire is drawn, its individual style may be changed with the **Edit > Edit Object** command.

Printing

Setting Print Parameters

The **File > Print Setup** command controls various printing parameters.

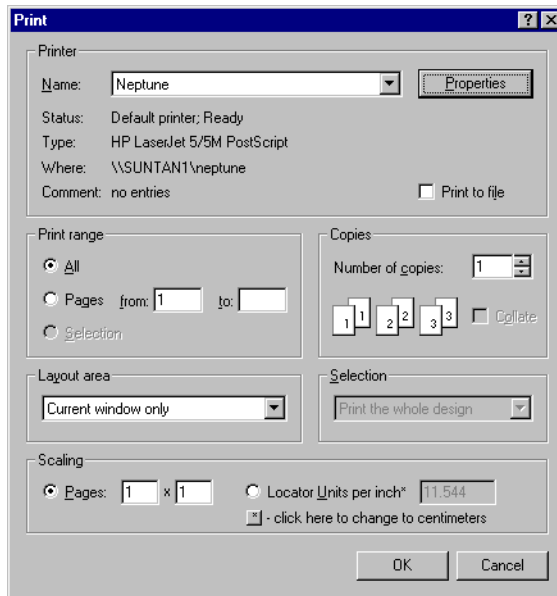


The **Print Setup** dialog controls printer selection, paper size, paper source, and print orientation (portrait and landscape). For more information on print setup, see [File > Print Setup](#).



The Print Command

The **File > Print** command displays the following dialog.



In this dialog, you can:

- Choose your printer.
- Choose to print hard copy or to file.
- Set the print range.
- Choose whether you want to print the entire cell or just that part of the cell displayed on your monitor.
- Scale your printout.

Automatic scaling allows you to specify the width of the printout in pages. The height of the printout is scaled to preserve a 1:1 aspect ratio by default.

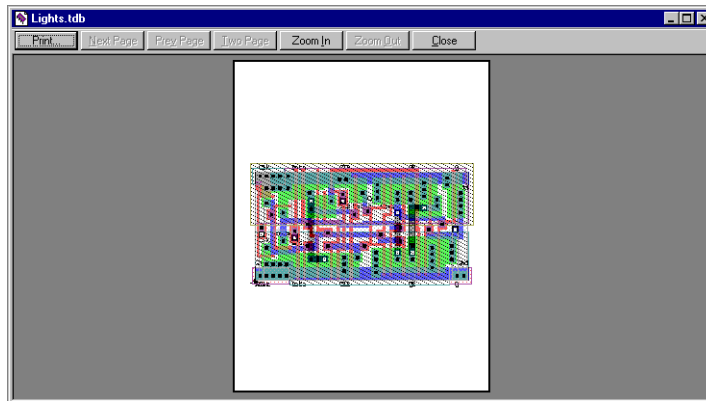
Fixed scaling allows precise control over the size of the objects on the printout. You specify the ratio of Locator Units per inch or per centimeter.

Lower resolution results in faster printing.

For more detail on the **Print** command, see [File > Print](#).

Print Preview

File > Print Preview displays a preview of the print of the active cell on your monitor, as shown below.



You can also preview text or a cell hierarchy in addition to layout.