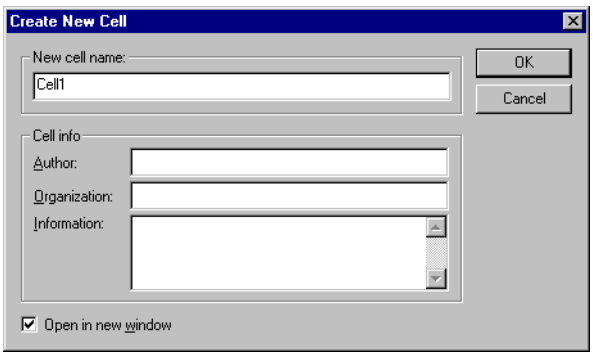
9 Working with Cells

Creating Cells

The cell is the basic building block of the integrated circuit design. To create a new cell, choose **Cell > New** or press **N**.



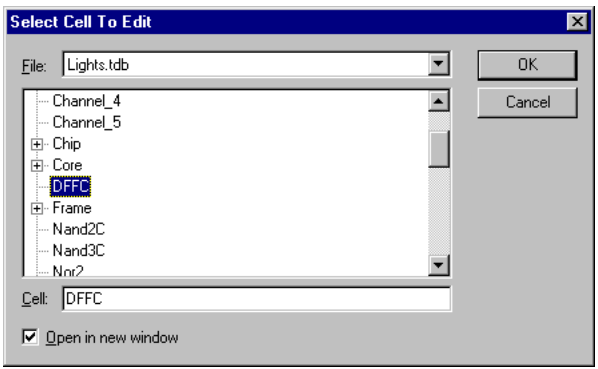
Options include:

New cell name — The name of the new cell. Each component cell of a file must have a unique name.

Cell info	Includes **Author**, **Organization**, and **Information** (notes or messages) for the active cell.
Open in new window	Instructs L-Edit to open a cell in a new layout window. The **Select Cell To Edit** dialog (accessed with **Cell > Open**) has an identical option. Setting this option in either dialog controls the behavior for both commands. L-Edit saves last state of this check box when you exit the application.

Opening Cells

To open a cell, choose **Cell > Open**, press **O**, or click the open cell button ( ).



Options include:

File — The name of the current file (default) or of any other open file.

Cell list — The specified file's component cells are displayed in the scrollable list. To open a cell, select it and click **OK** or double-click it.

Open in new window

Instructs L-Edit to open a cell in a new layout window. The **Create New Cell** dialog (accessed with **Cell > New**) has an identical option. Setting this option in either dialog controls the behavior for both commands. L-Edit saves last state of this check box when you exit the application.

If a cell name is in boldface type, it indicates that the cell has been edited but that the changes have not yet been saved.

If an instance is selected in the layout, its name will be highlighted in the **Open Cell** dialog. If multiple instances are selected, the referenced cell of the first instance in the selection will be highlighted.

If no instance is selected, the last cell opened will be highlighted.

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.

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 the title bar.

Reverting Cells

Cell > Revert Cell allows you to reverse all changes made to the active cell after any the following operations:

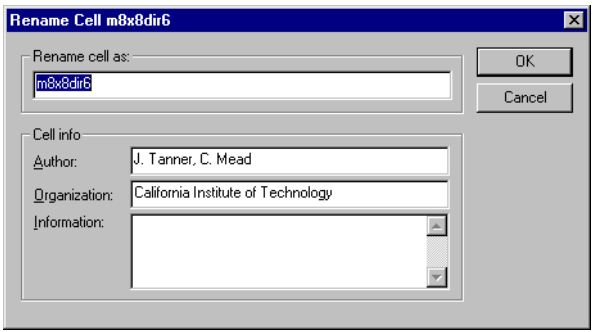
- **File > Save**
- **Tools > Generate Layers**
- **Tools > DRC**
- **Tools > Extract**
- **Draw > Assign GDSII Data Types**
- **Draw > Clear Rulers**
- **Tools > Clear Generate Layers**
- **Tools > Clear Error Layers**

Note: The revert cell command cannot be undone using **Edit > Undo**.

Renaming Cells

To rename the current cell, choose **Cell > Rename** (or press **T**), or choose **Cell > Close As**.

Cell > Rename presents a dialog to rename the cell. When **OK** is clicked, the renamed cell stays open.



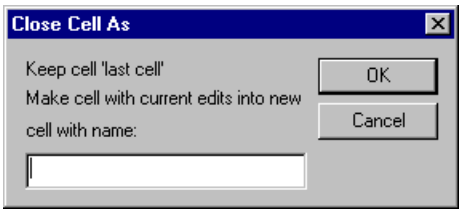
Options include:

Rename cell as The new name of the active cell.

Cell info — Includes text fields for **Author**, **Organization**, and **Information** (notes or messages) for the active cell, which can be edited.

Cell > Close As copies the cell with all current changes 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 contains a field to enter the new cell's name.



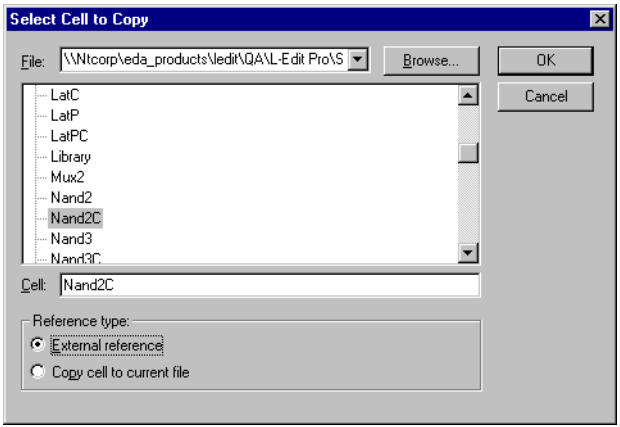
Copying Cells

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.

Note: There is a UPI macro that allows you to save just one cell and its hierarchy to another file; see the upilib.wri file in the upilib folder of your L-Edit installation directory for documentation.

To copy cells, choose **Cell > Copy**, press **C**, or click the copy cell button ().



Options include:

File

Name of the active file (default) or any other file specified from the drop-down list. In the drop-down list, TDB files that are open but not active are displayed in red, cross-referenced TDB files are displayed in blue.

Cell

Enter the cell's name here, or highlight it on the scrollable list of the specified file's component cells, which is displayed in the above this field. Click **OK** or double-click a highlighted cell name to open the **Cell Copy** dialog.

Reference type

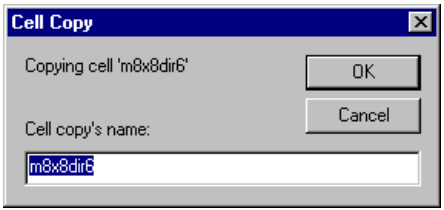
Options include:

- **External reference**—creates an XrefCell, as described in XrefCells on page 1-399
- **Copy cell to current file**—creates a copy of the specified cell in the current file

If an instance is selected in the layout, the referenced cell will be highlighted in the **Select Cell to Copy** dialog. If multiple instances are selected, the referenced cell of the first instance in the selection will be highlighted.

If no instance is selected, the current cell will be highlighted.

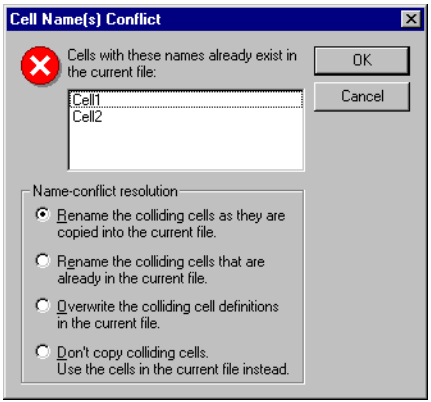
When you click **OK**, L-Edit will prompt you to name the copy.



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 L-Edit detects a name conflict, it prompts you to select one of four options required to complete the copy.



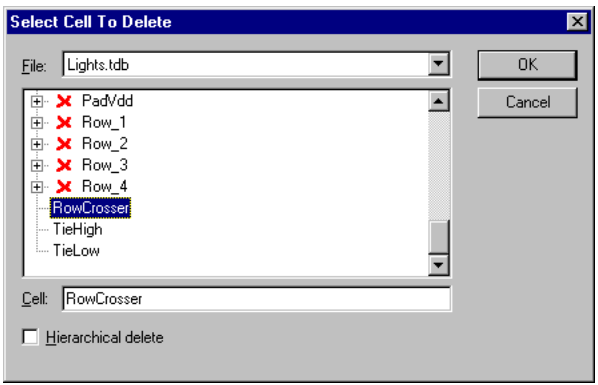
Options include:

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.

Deleting Cells

To delete a cell, choose **Cell > Delete** or press **B**. L-Edit displays the **Select Cell To Delete** dialog:



Options include:

File — The name of the active TDB file (default). All open TDB files are listed in the drop-down list.

Cell

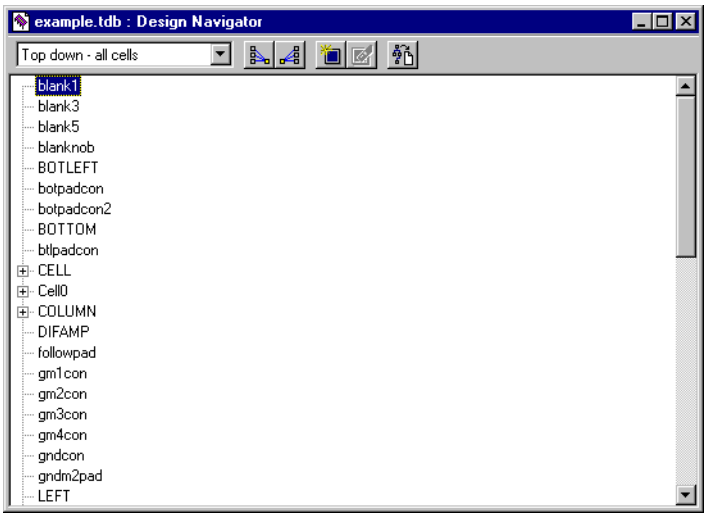
The specified file's component cells are displayed in the scrollable list. Cells which cannot be deleted (due to being instanced in other cells) have a red (**x**) next to them. Highlight an available cell and click **OK** to delete the cell.

Hierarchical delete

Checking this box causes all cells instanced within the selected cell to also be deleted, unless they are instanced in additional cells.

Design Navigator

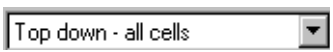
The Design Navigator lists all cells in the design in a hierarchical structure, including information on instances, XrefCells and files, and fabrication cells. To open the Design Navigator, use **View > Design Navigator** or click  in the Standard toolbar.



Cells in the design are listed in alphabetical order. Xref files and their cells are displayed in blue following all of the cells in the active file.

The hierarchy is analogous to Windows Explorer: A **+** icon indicates a collapsed state and a **-** icon indicates an expanded state. To expand or collapse the cell list click the **+** or **-** icon.

The Design Navigator toolbar contains buttons for the following operations:



Select the desired display mode from the drop-down list. (See Display Modes, below.)

Collapse all cells to display only the top level.

Expand all cells to display all levels of instancing.

Create a new cell.

Delete the selected cell. This operation is only available when the selected cell is not instanced in another cell.

Copy the display to text view.

Display Modes

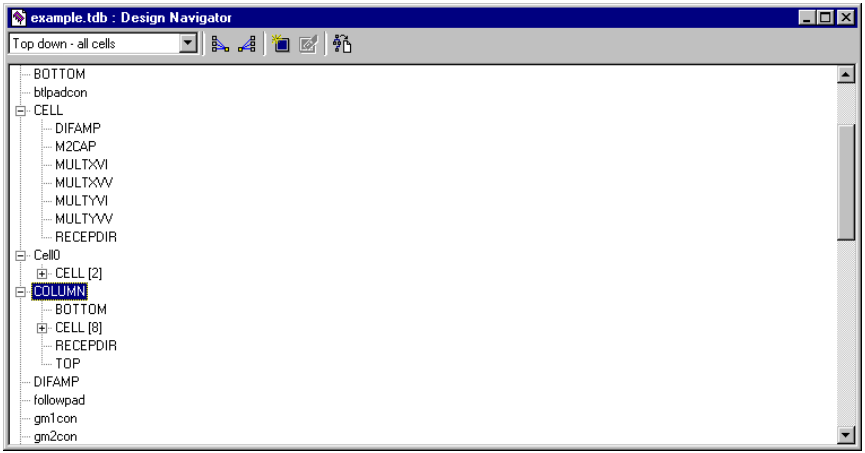
You can view the display in four modes:

- **Top down - all cells**
- **Bottom up - all cells**
- **Top down - non-instanced**
- **By date modified**

To change the display select the desired mode from the drop-down list on the Design Navigator toolbar. Examples of each mode are illustrated below. The Design Navigator always opens in **Top down - all cells** mode.

Top down - all cells

In this mode cells are hierarchically listed in terms of instances they contain. When a cell contains instances and is collapsed, it is marked with a plus icon (**+**). When you expand the cell, the instanced cells are listed below it. Numbers in brackets indicate the number of times the particular cell is instanced in the higher cell.

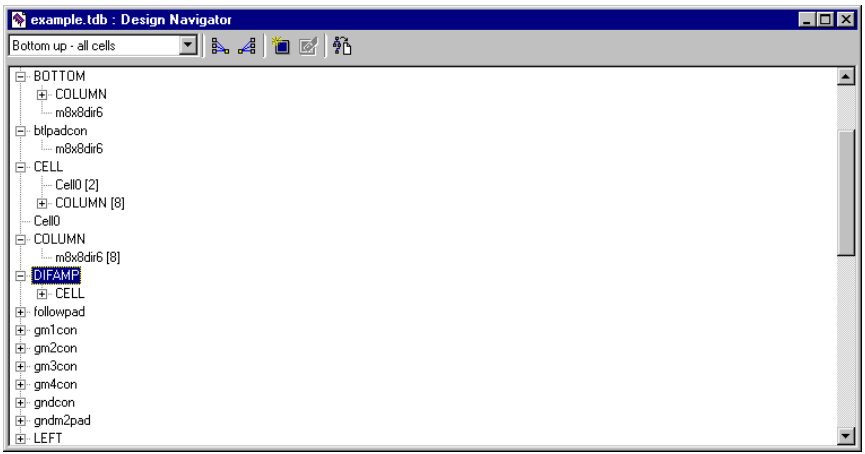


In the illustration above, **COLUMN** contains instances of four cells: **BOTTOM**, **CELL**, **RECEPTDIR**, and **TOP**. **CELL** is instanced eight times in **COLUMN**, and **CELL** contains instances of other cells as well (indicated by the **+** icon).

Bottom up - all cells

In this mode cells are listed in terms of where they are instanced. When a cell is instanced in other cells it is marked with a **+** and the cells which contain it as an

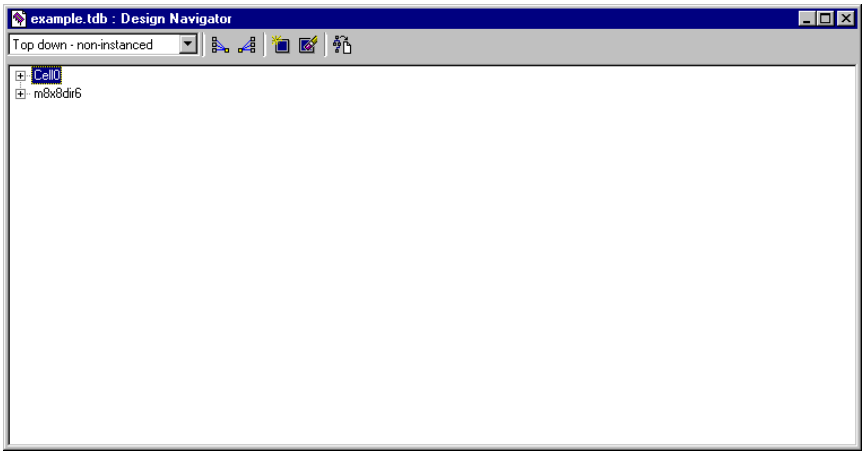
instance are listed below it. Numbers in brackets indicate the number of times the higher-level cell is instanced in the particular cell.



In this illustration, cell **CELL** is instanced in two other cells: Twice in **Cell0** and eight times in **COLUMN**. **COLUMN** is also instanced in other cells (indicated by the **+** icon).

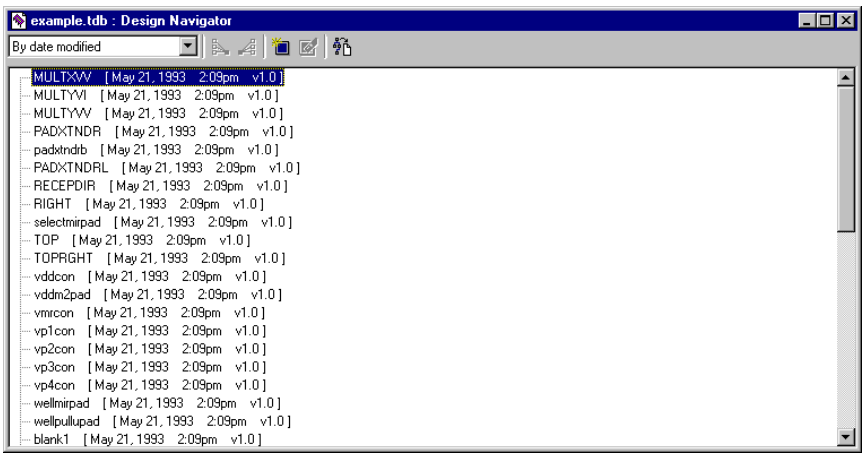
Top down - non-instanced

Only cells which are not instanced in other cells are listed in this mode.



By date modified

All cells are displayed and sorted by modification date/time. The newest cells are at the top; the oldest are at the bottom. Version is displayed for reference only. Subcells are not displayed in this mode.



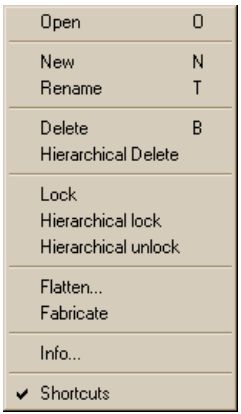
Copy Display to Text View

The Design Navigator can convert its cell tree display to a text representation by pressing the Copy To Text View button ( ) on the Design Navigator tool bar.

The text view will formatted to reflect the displayed cell tree. For example, if the displayed cell tree is in **top down - all cells** mode, the text view will also be ordered that way. If the cell is locked, the word “locked” will appear in brackets to the right of the cell name.

Performing Operations on Cells

The Design Navigator contains a context-sensitive menu of available commands. To access the menu, select a cell and click the right mouse button.



Options include:

Open	Opens the selected cell.
New	Creates a new cell.
Rename	Renames the selected cell.
Delete	Deletes the selected cell. This command is only available when the selected cell is not instanced in another cell.
Hierarchical Delete	Deletes the selected cell and all cells instanced in it. This command is only available when the instanced cells are not instanced anywhere else.
Lock	Locks/unlocks the selected cell.
Hierarchical lock	Locks the selected cell and all cells that are instanced in it.(Please see Hierarchical Lock/Unlock, below)
Hierarchical unlock	Unlocks the selected cell and invokes a warning dialog that asks if the user wants to individually unlock each cell that is instanced in it. The dialog also gives the option to unlock all instanced cells. (Please see Hierarchical Lock/Unlock, below)
Flatten	Flattens the hierarchy of the selected cell.

Fabricate Marks the selected cell for fabrication.

Info Displays the **Cell Information** dialog for the selected cell.

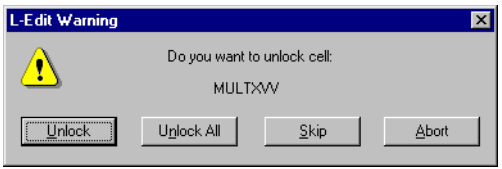
Shortcuts Specifies the use of keyboard shortcuts or cycle selection in the Design Navigator.

- **On**—Keyboard shortcuts are active, i.e. pressing **O** will open the selected cell, not cycle the selection to the first cell that begins with the letter **O**.
- **Off**—Keyboard shortcuts are inactive to allow cycle selection by typing the first few letters of a cell name.

Hierarchical Lock/Unlock

Hierarchical locking and unlocking allows you to lock and unlock cells and all of their instanced cells so that a locked cell cannot be modified during an edit in-place operation.

In hierarchical unlocking, the top-level cell is unlocked, L-Edit prompts you for permission to individually unlock each cell that is instanced in it. The dialog also gives the option to unlock all instanced cells.



Locking and unlocking will always be exclusive. For example, if cell A and cell B both instance cell C, and hierarchical lock is performed on cells A and B, all three cells will be locked. If cell A is subsequently hierarchically unlocked, cell C will be unlocked, including its instance in cell B.

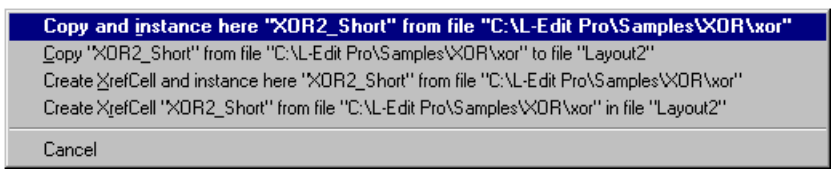
Depending on the state of the selected cell and the associated file, some menu items will be disabled:

Condition	*Disabled Items*
File is locked.	All items except for **Open**, **Info**.
Selected cell is instanced in another cell.	**Delete**, **Hierarchical Delete**.
Selected cell is locked.	**Flatten**, **Rename**, **Delete**, **Hierarchical Delete**.

Copying and Instancing

You can copy and instance cells to another file directly from the Design Navigator through drag-and-drop operations:

- If you drag and drop a cell from the Design Navigator onto the layout of the same file, L-Edit creates an instance of the cell.
- If you drag and drop a cell from the Design Navigator onto the Design Navigator of another file, L-Edit creates a copy of the cell in the other file.
- If you drag and drop a cell from the Design Navigator onto layout of another file, L-Edit will prompt you to either copy and instance, copy, create an XrefCell, or instance or create an XrefCell, using a menu like this:



- If you drag and drop a cell from an Xref file that is already in the active TDB file, then the instance is set to the existing XrefCell.

Printing

You can print the cell hierarchy when the Design Navigator 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]** or **[Fabricate]**.

XrefCells

An *XrefCell* is a cell that references (is linked to) a cell in another TDB file. There are three ways to create an XrefCell in your active file:

- By copying or instancing library cells using the Design Navigator (see Design Navigator on page 1-386)
- By copying a cell from another file using the external reference option (see Copying Cells on page 1-378)
- By instancing a cell from another file using the external reference option (see Creating Instances on page 1-424)

When you create an XrefCell, L-Edit takes a "snapshot" of the referenced cell and places it in the active file, with a link to the referenced cell. This "snapshot" is the XrefCell.

XrefCells are identified with a "link" icon () in the Design Navigator and various cell dialogs. You can view and open XrefCells just as you would other cells. XrefCells are read-only and cannot be edited; to modify one, you must edit the referenced cell in the referenced file and update the link (see Updating XrefCells on page 1-407).

XrefCells follow the same naming conventions as ordinary cells. By default, the XrefCell name matches the referenced cell name, but the XrefCell must have a

unique name within the local file. If the active file already has a cell with the same name as the new XrefCell, L-Edit prompts for a new name for the XrefCell.

You can change the name of an existing XrefCell using **Cell > Rename**. See Renaming Cells on page 1-376 for further information.

L-Edit supports a library concept in the use of GDSII files. If a cell reference is in the GDSII file but the cell's contents (structure and layout) are not, then that cell is considered an XrefCell.

In this case, during GDSII import, L-Edit will create an XrefCell reference and will attempt to automatically establish the link by locating the cell using its cell name in each TDB Xref file. L-Edit searches the TDB files in the order that they are listed in the **Setup > Design—Xref files** dialog (see Cross Reference File Designation on page 1-151). Once L-Edit finds a matching cell name, the link is established and no further searching is done.

If L-Edit does not find the referenced external cell in any of the cross-referenced TDB libraries, it will create a blank cell and open the **Examine XrefCell Links** dialog to allow you to redirect the missing cell definition at the end of the GDSII import operation (see Examining XrefCells, below).

Examining XrefCells

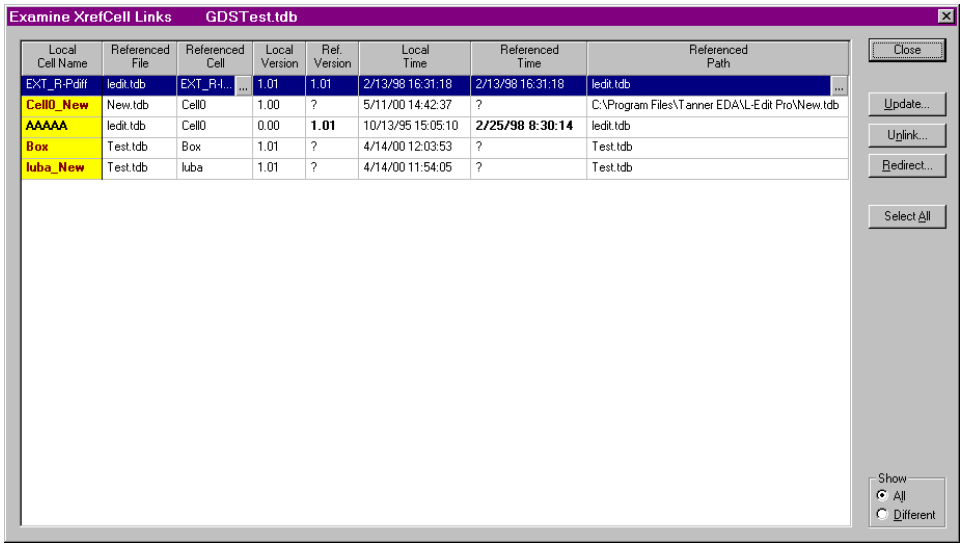
The **Examine XrefCell Links** dialog lists all XrefCells in the file and indicates any differences between the XrefCells and the referenced cells. You use this dialog to:

- Update an XrefCell
- Unlink an XrefCell and convert it to an ordinary cell
- Change a referenced cell—that is, reference a different cell within the referenced file
- Redirect an XrefCell—that is, change the filename and/or path to the referenced file

You can open the **Examine XrefCell Links** dialog in two ways:

- Choose **Tools > Workgroup > Examine XrefCell Links**.
- Choose **File > Open** to open a TDB file that contains XrefCells. In the **Open** dialog, click the option **Check XrefCells**. If the cells require updating, the **Examine XrefCell Links** dialog will appear.

The **Examine XrefCell Links** dialog looks like this:



Columns include:

Local Cell Name

The name of the XrefCell. Yellow shading indicates that a difference exists between the XrefCell and the referenced cell.

- Black boldface type indicates that the referenced cell has a more recent version or time than the XrefCell.
- Red type indicates that the referenced cell no longer exists.
- Green type indicates that the XrefCell has a more recent version and time than the referenced cell.

Referenced File

The name of the file that contains the referenced cell.

Referenced Cell

The name of the referenced cell in the referenced file. To reference a different cell, click the ellipsis button (). The dialog **Change Referenced Cell** appears. See Changing the Referenced Cell on page 1-406.

Local Version

The version of the snapshot of the referenced cell. Boldface type indicates that the XrefCell has a higher version number than the referenced cell.

Ref. Version

The current version of the referenced cell. Boldface type indicates that the referenced cell has a higher version number than the XrefCell.

Local Time

The date and time of the snapshot of the referenced cell. Boldface type indicates that **Local Time** is later than **Referenced Time**.

Referenced Time

The date and time that the referenced cell was last modified. Boldface type indicates that **Referenced Time** is later than **Local Time**.

Referenced Path

The path for the referenced file. Click the ellipsis button () to redirect the selected referenced cell(s) with either a relative or full path. See Redirecting XrefCells on page 1-410.

Controls include:

Update — Updates the selected XrefCell(s) with the latest information from their source files. (See Updating XrefCells, below.)

Unlink — Unlinks the selected XrefCell(s) from their referenced cells and converts them to ordinary cells. You cannot undo or cancel an **Unlink** operation. (See Unlinking XrefCells on page 1-409.)

Redirect — Allows you to redirect the selected cell(s) with either a relative or full path. See Redirecting XrefCells on page 1-410.

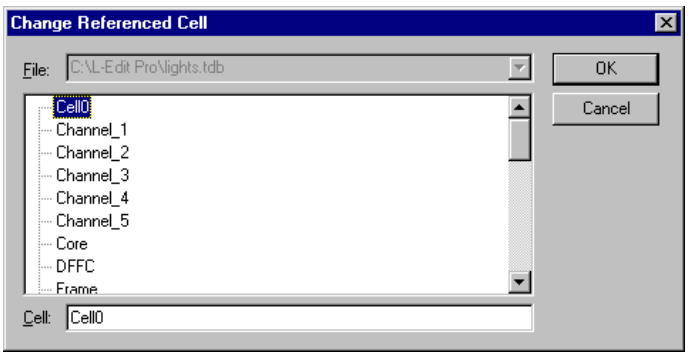
Select All — Selects all XrefCells in the list.

Show

- **All** instructs L-Edit to display all XrefCells.
- **Different** instructs L-Edit to display only XrefCells that require updating.

Changing the Referenced Cell

You can link an XrefCell to a different referenced cell by clicking the ellipsis button (...) in the **Referenced Cell** field. L-Edit will display the dialog **Change Referenced Cell**:



Select the cell you want to use as the new referenced cell and click **OK**. L-Edit will change the cell reference, but it will not update the layout. To update the layout, you must update the affected cell in the **Examine XrefCell Links** dialog. L-Edit will prompt you to take this step whenever you change a referenced cell.

Updating XrefCells

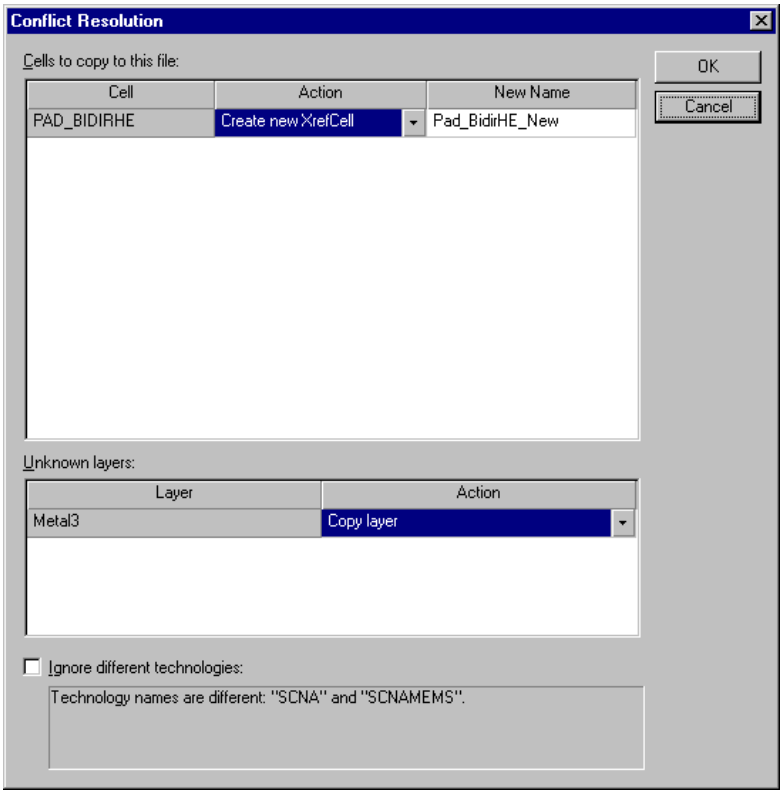
L-Edit does not update XrefCells automatically when changes are made to their referenced cells. To update XrefCells, you must open the file containing them, open the **Examine XrefCell Links** dialog, select the XrefCells to update, and click **Update**.

When you create or update an XrefCell, the XrefCell acquires the following information from the referenced cell:

- The current version number of the cell
- The date and time the cell was last modified
- Geometric design changes to the cell, including changes on special layers or generated layers
- Extract options

L-Edit verifies that the referenced cell and the referenced file still exist. If they do not or if their names have been changed, L-Edit displays a warning.

In some cases, the local file and the referenced file may have conflicting cell names, layers, or technologies. If such a conflict occurs, L-Edit will prompt you to resolve it:


Conflict Resolution
Cells to copy to this file:
OK
Cancel
Cell
Action
New Name
PAD_BIDIRHE
Create new XrefCell
Pad_BidirHE_New
Unknown layers:
Layer
Action
Metal3
Copy layer
Ignore different technologies:
Technology names are different: "SCNA" and "SCNAMEMS".

This dialog is dynamic, and only the portions needed to resolve a particular conflict will appear at any given time. Click the relevant fields to choose an action or type a new cell name.

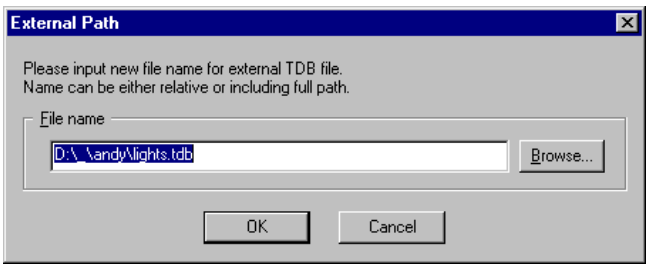
Unlinking XrefCells

You can unlink XrefCells from their source files by clicking **Unlink** in the **Examine XrefCell Links** dialog (see Examining XrefCells on page 1-401). A message indicates the link to the referenced cell will be broken and the XrefCell will become a regular cell in the file. You can then edit the cell directly.

Warning: L-Edit does not first update an XrefCell when you click **Unlink**. You must explicitly update an XrefCell before converting it if you want the converted cell to reflect the latest information from the source cell. (For information on updating XrefCells, see Updating XrefCells, above.) You cannot undo or cancel an **Unlink** operation.

Redirecting XrefCells

You can redirect the XrefCell cell—that is, change the filename and path of the file containing the referenced cell—by clicking the ellipsis button (...) in the **Referenced Path** field for the selected cell. The **External Path** dialog appears:

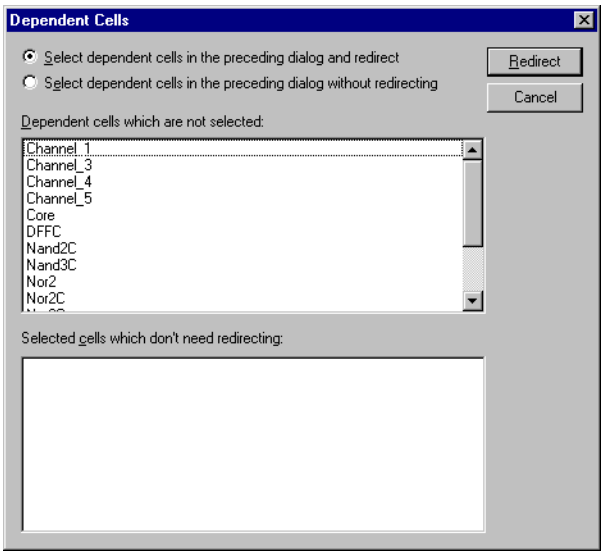


In **File name**, type the filename and path, or click **Browse** to navigate to the desired file and click **OK**.

Dependent Cells

In some cases, the XrefCell selected for updating, unlinking, or redirecting may contain instances of other cells. In other cases, the XrefCell will itself be instanced in a higher-level cell. Cells that instance, or are instanced by, XrefCells are called “dependent cells,” and they are also affected by any operation you perform on an XrefCell.

Whenever you update, unlink, or redirect an XrefCell, L-Edit prompts you to perform the specified action on its dependent cells:



This dialog is dynamic, and its exact appearance will depend on the specified action—updating, unlinking, or redirecting. Options include:

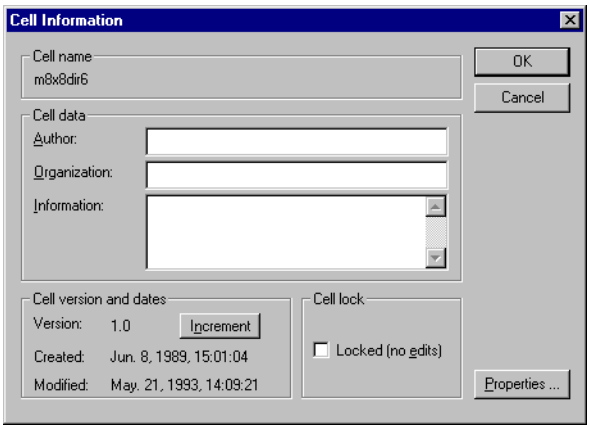
Select dependent cells in the preceding dialog and redirect	Adjusts the selection in the **Examine XrefCell Links** dialog to include all dependent cells and exclude all non-dependent cells, then performs the specified operation on the selected cell(s).
Select dependent cells in the preceding dialog without redirecting	Adjusts the selection in the **Examine XrefCell Links** dialog to include all dependent cells and exclude all non-dependent cells without redirecting selected cell(s).
Dependent cells which are not selected	Informational only. A list of dependent cell(s) not currently selected that: ▪ Contain the selected cell(s) ▪ Instance the selected cell(s) ▪ Are instanced by the selected cell(s) ▪ Are instanced by parents of the selected cell(s)
Selected cells which don't need redirecting	Informational only. A list of selected cells that are not affected by the specified action.
Redirect, **Unlink**, or **Update**	Initiates the specified action.

Deleting XrefCells

You can delete XrefCells in the Design Navigator or by choosing **Cell > Delete**.

Cell Information

Use **Cell > Info** to edit information on the active cell.



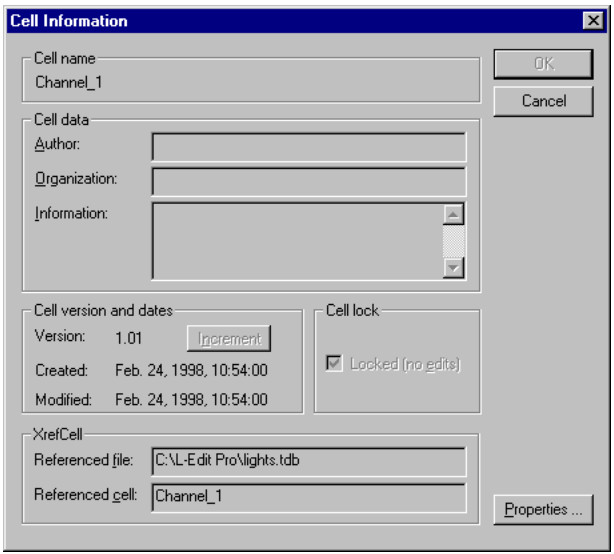
Options include:

Cell name Name of the active cell

Cell data	Includes **Author**, **Organization**, and **Information** (notes or messages) for the active cell. **Information** can contain a maximum of 256 characters.
Cell version and dates	The date and time the cell was created and last modified. The version numbering system provides an internal accounting method for tracking changes. **Increment** increases the version number to the next major version (for example, 1.3 to 2.0). L-Edit automatically increments the minor version number (e.g. 1.3 to 1.4) each time changes in the cell are saved.
Cell lock	Switches the cell between locked and unlocked states. Locked cells cannot be edited, but objects in them may be selected and copied to other cells, and the cell can be instanced in other cells.
Properties	Opens the **Properties** dialog for the cell. For information on cell properties, see Properties on page 1-70.

Cell Information for XrefCells

The **Cell Information** dialog for XrefCells contains additional fields for XrefCells.



Referenced file is the name and path of the TDB file which contains the referenced cell. **Referenced cell** is the name of the referenced cell. All of the

information in the **Cell Information** dialog for an XrefCell pertains to the referenced cell and is read-only and cannot be edited.

Cell State Symbols

L-Edit uses a number of symbols to convey information on the cells in each of the dialogs accessed with the **Cell** menu commands. The following table describes each symbol.

Cell0	Cells with unsaved changes are in bold.
	A locked cell.
	In the **Select Cell to Delete** dialog, a cell that cannot be deleted. In the **Select Cell to Instance** dialog, a cell that cannot be instanced.
	A locked cell that cannot be deleted or instanced.
	The fabrication cell.
	A locked fabrication cell.
	A fabrication cell that cannot be deleted or instanced.

A locked fabrication cell that cannot be deleted or instanced.

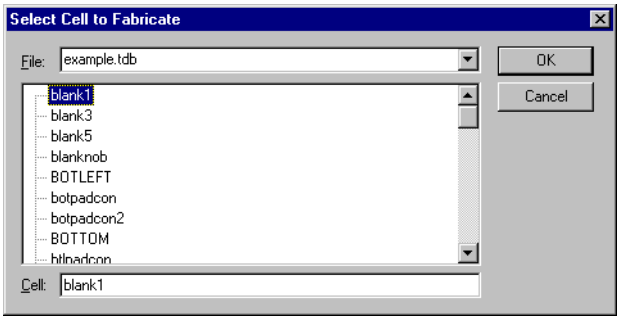
Specifying the Fabrication Cell

Before fabricating your design, you must supply your fabricator with the name of the cell that represents the top level of your design. If you do not specify this information, your fabricator may incorrectly identify this cell.

Identifying the fabrication cell instructs L-Edit to tag the cell as such when it exports a CIF file. 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 identify the fabrication cell before writing a CIF file!*

Identify the cell to fabricate by choosing **Cell > Fabricate**.



Options include:

File — Name of the active TDB file (default). All open TDB files are listed.

Cell — The specified file's component cells are displayed in the scrollable list. Highlight a cell and click **OK** to tag it.