8 Working with Objects

Selecting Objects

Selecting an object specifies that subsequent editing operations affect that object specifically. More than one object may be selected at a time.

By default, selected objects are outlined. It is possible to change the manner in which selection is displayed on any given layer by modifying the layer setup (see Layer Setup on page 1-155).

When multiple views of the same cell are open, selected objects are displayed as such in all of the views.

When a selected object is part of an instance, it is only displayed as selected in its original (instanced) cell.

For information on the selection range, see Selection Parameters on page 1-141.

L-Edit provides several ways to select an object, using the selection tool  in the Drawing toolbar. The following table summarizes basic methods of selection, and the following sections provide a more detailed explanation of selection methods.

Action	*Mouse button*
Explicitly select an object or set of objects before an operation is performed.	SELECT
Implicitly select an object in the process of performing an operation on it.	MOVE/EDIT
Add an object to a set of selected objects.	EXTEND SELECT (**Shift**+SELECT)

Explicit Selection

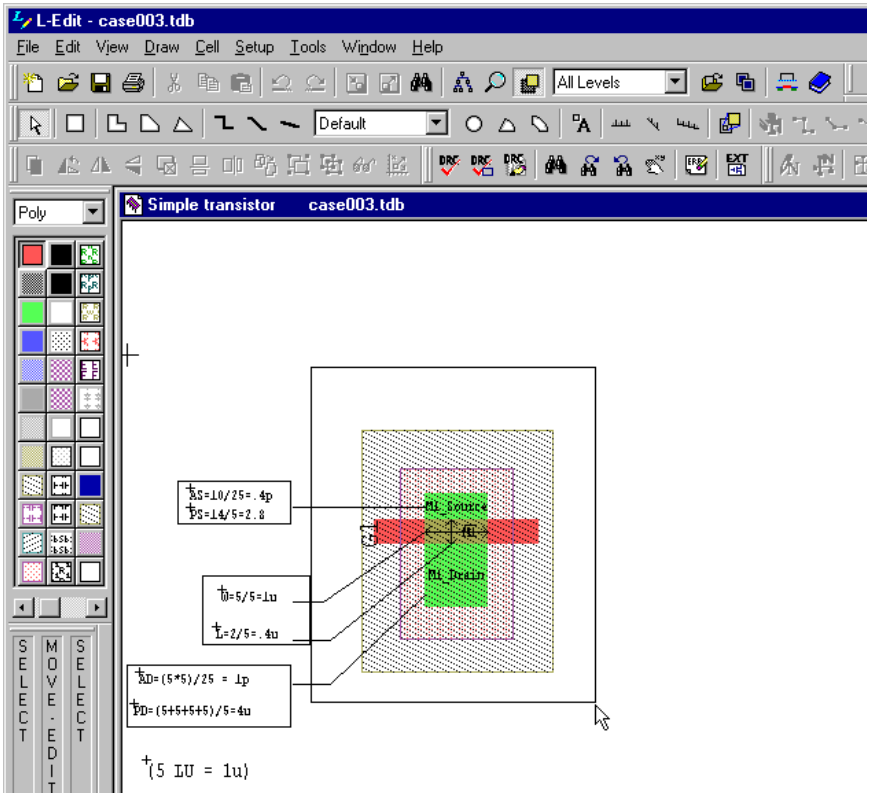
To explicitly select an object, position the pointer over the object to be selected and click the SELECT button. Any previously selected objects are automatically deselected.

You can also explicitly select a set of objects by dragging a selection box around them, as follows:

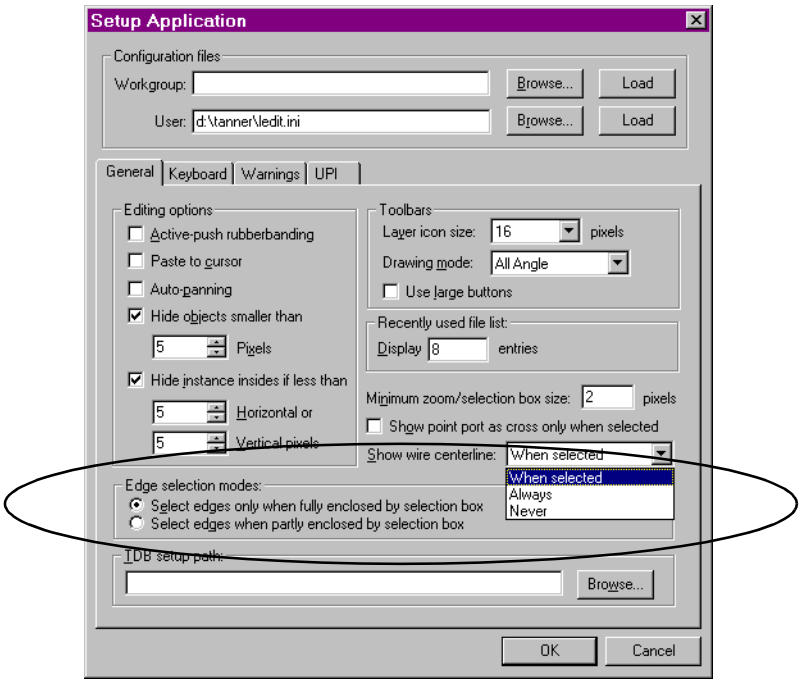
☑ Position the pointer outside the set of objects to be selected.

☑ Drag the pointer with the SELECT mouse button held, forming a *selection marquee* around the objects.

☑ Position the opposite corner of the selection marquee so that the marquee completely encloses all the objects to be selected but does not completely enclose any other objects, and release the SELECT mouse button.


L-Edit - case003.tdb
File Edit View Draw Cell Setup Tools Window Help
All Levels
Default
Poly
Simple transistor case003.tdb
AS=10/25=.4p
PS=14/5=2.8
W=5/5=1u
L=2/5=.4u
AD=(5*5)/25 = 1p
PD=(5+5+5+5)/5=4u
(5 LU = 1u)
M1_Source
M1_Drain
SELECT
MOVE-EDIT
SELECT

You can control the behavior of the selection box using the **Edge selection modes** options in the **Setup Application** dialog .



If you choose **Select edges only when fully enclosed by selection box**, L-Edit will only select objects completely contained within the selection box. Any previously selected objects will be deselected.

If you choose **Select edges when partly enclosed by selection box**, L-Edit will select all objects completely or partly contained within the selection box.

Implicit Selection

If no other objects are selected, pressing and holding the MOVE/EDIT mouse button in or near an object (within the selection range) selects that object and begins a move or edit operation.

Note that implicit selection is governed by the values set for selection range and deselection range. (See Selection Parameters on page 1-141.) Depending on these values, you may accidentally include previously selected objects (outside the deselection range) when you select another object implicitly.

There are two ways to avoid this potential problem:

- Use **Edit > Deselect All** to deselect all objects before you perform implicit selection.
- Set the deselection range appropriately.

Extend Selection

You can extend a selection by including another object or group of objects in the set of already selected objects. Select the additional object(s) with the EXTEND SELECT (**Shift**+SELECT) mouse button. Previously selected objects are not deselected.

Cycle Selection

When you click repeatedly within the selection range of several objects, L-Edit selects each object in turn. The first click selects the closest object. The next click with the pointer in the same spot deselects the object just selected and selects the next closest object (within the selection range).

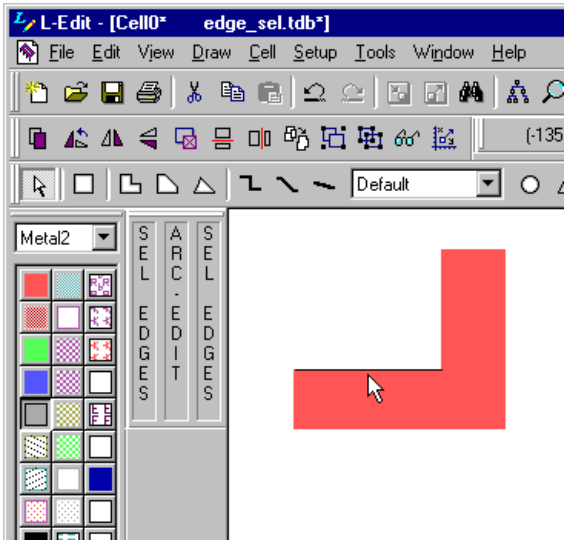
Repeated clicks progressively select nearby objects until there are no more objects within the selection range. The next click deselects all objects. The following click repeats the cycle, beginning with the closest object.

A message at the left end of the status bar reports which object is selected.

Edge Selection

In addition to selecting whole objects, you can also select individual edges of one or more objects. The following illustrations explain these techniques.

You can directly select the edge of an object by clicking it:

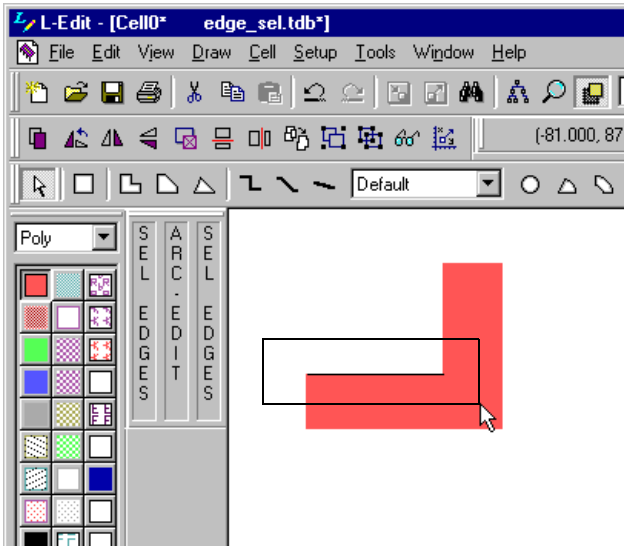


Select the edge of an object by clicking it with the SELECT EDGES mouse button (Ctrl+Right SELECT)

You can also select an edge by pressing the SELECT EDGES mouse button (**Ctrl**+Right SELECT) and dragging a selection box around the desired edge(s). In this case, L-Edit will select a single edge or multiple edges, according to edge

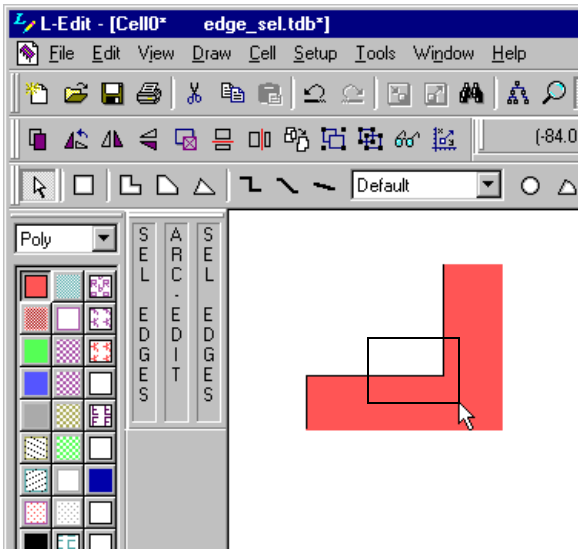
selection mode chosen in **Setup Application—General** (see General on page 1-115).

If you choose the selection mode **Select edges only when fully enclosed by selection box**, you must drag the selection box completely around the edge you wish to select:



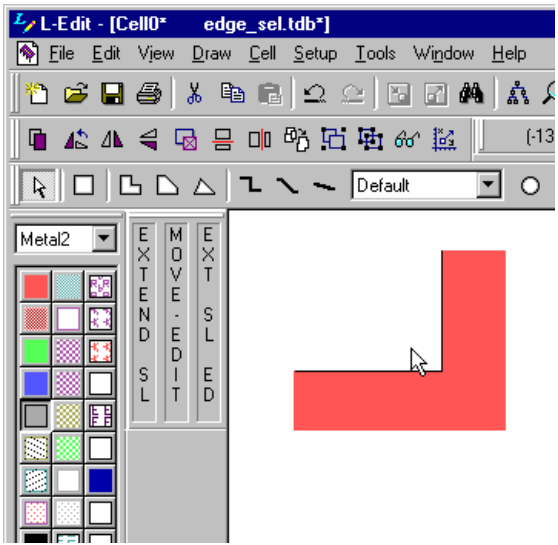
Select an edge by pressing the SELECT EDGES mouse button (Ctrl+Right SELECT) and dragging a selection box around the desired edge(s)

If you choose the selection mode **Select edges when partly enclosed by selection box**, you need only partly enclose the edge you wish to select. Use this technique to select multiple adjacent edges:



Select multiple edges by pressing the SELECT EDGES mouse button (Ctrl+Right SELECT) and dragging a selection box that partly encloses the desired edge(s)

Finally, you can cyclically select one or more edges, as the following illustration demonstrates:



Click the SELECT EDGES (Ctrl+Right SELECT) mouse button within the selection range of the desired edge. To extend the selection to include additional edges, use Shift+SELECT EDGES (Shift+Ctrl+Right SELECT).

Universal Selection

You can select all objects in the active cell by choosing **Edit > Select All** or pressing **Ctrl + A**.

Deselecting Objects

Deselecting objects causes them to no longer be available for editing operations.

A deselection range ensures that selected objects will not accidentally be deselected before an operation is performed. For information on the deselection range, see Selection Parameters on page 1-141.

Explicit Deselection

To deselect a selected object without affecting other selected objects, place the pointer within the selection range of the object and use the DESELECT (**Alt**+right SELECT) mouse button.

Clicking the DESELECT button near an object which is not selected or outside the selection range of all selected objects has no effect.

Implicit Deselection

Clicking the SELECT button outside the selection range of selected objects automatically deselects the objects.

Hidden Deselection

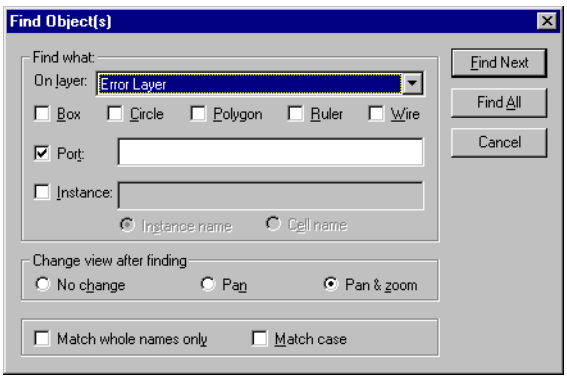
When a layer is hidden, all selected objects on that layer are automatically deselected. This prevents hidden objects from being moved or edited. These objects remain deselected even after they are made visible again.

Universal Deselection

You can deselect all objects in the active cell by choosing **Edit > Deselect All** or pressing **Alt + A**.

Finding Objects

To search for geometric objects or for ports or instances of a particular name, choose **Edit > Find**, press **Ctrl + F**, or click the find button ( ).



Options include:

Find what

A **Box**, **Circle**, **Polygon**, **Ruler**, and/or **Wire** search finds the object(s) on the layer specified in the **On layer** field. A **Port** search finds ports by name on the layer specified in the **Port** field. When no layer is specified, L-Edit searches for the specified items on all layers. An **Instance** search finds instances by the **Instance name** or the originating **Cell name** specified in the **Instance** field.

Change view after finding

Controls the view when **L-Edit** finds the specified object.

- **Pan** centers the view on the found object.
- **Pan & Zoom** centers the view on the found object and zooms in or out so that the object fills the active layout window.
- **No change** leaves the view unchanged.

Match whole names only

Instructs L-Edit to select only objects whose names exactly match the specified text. Without this option, L-Edit selects any port or instance containing the search term as a portion of the full name.

Match case	Instructs L-Edit to perform a case-sensitive search.
Find Next	Finds and selects the next matching item.
Find All	Finds and selects all matching items at once.

During an L-Edit session, search parameters typed in the **Find Object(s)** dialog remain in memory and are used for all subsequent **Find** operations. The search parameters are not cleared when you switch between cells and files.

Find Next/Find Previous

When an object has been found, you can search for the *next* object or for the *previous*ly found object. Choosing **Edit > Find Next**, pressing **F**, or clicking the find next button () prompts L-Edit to search for and select the next object satisfying the current search criteria.

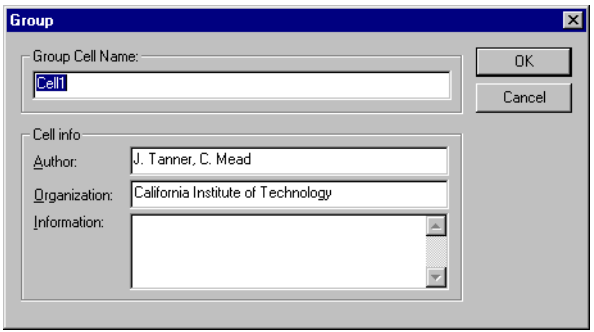
Choosing **Edit > Find Previous**, pressing **P**, or clicking the find previous button () prompts L-Edit to search for and select the previous object satisfying the current search criteria.

If the **Find** command has not yet been executed, the **Find Object(s)** dialog is opened. The **Find Next** and **Find Previous** operations use the current search criteria, even if those criteria were originally set in a different cell or file.

The **Find Next** and **Find Previous** operations select objects in a cyclical manner. When the last object matching the search parameters is found, L-Edit repeats the search, beginning with the first object found.

Grouping and Ungrouping Objects

The **Group** command creates a new cell containing the selected objects and instances the new cell in the active cell. Choose **Draw > Group** or press **Ctrl + G** to execute this command.



Options include:

Group Cell Name — The name of the new cell.

Cell info — Includes **Author**, **Organization**, and **Information** (notes or messages) for the new cell.

Any type of object (geometry, ports, instances) may be grouped. The command can also be used to create an array from selected instances of the same cell, 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, **Draw > 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, an array is automatically formed. If not, L-Edit prompts for the name of the new cell to be created from the selected objects.

Draw > Ungroup (**Ctrl + U**) flattens the selected instances into their component objects, without deleting the cell created by **Draw > Group**. When used on an array, the command "explodes" the array into its component instances.

Draw > Ungroup works independently of the **Group** command, however, and can be used to remove an array from any existing instance, however it was created. In other words, it works like **Cell > Flatten**, except that **Flatten** will flatten an entire cell, including all its instances, but **Ungroup** will flatten just one level down (only the selected instance or set of instances).

Reversing Group and Ungroup Operations

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

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

Moving Objects

You can move objects in L-Edit in four ways:

- Graphically move objects with the mouse (see Graphical Repositioning, below)
- Nudge objects over a preset distance (see Incremental Repositioning on page 1-358)
- Move objects over a specified distance (see Numerical Repositioning on page 1-359)
- Rotate or flip objects (see Reorienting on page 1-360)

Note: If the object is drawn on a locked layer, it cannot be edited or moved. To edit or move such an object, you must first unlock the currently locked layer or layers.

Graphical Repositioning

To move an object, select it and position the pointer anywhere except on a vertex or edge of the selected object. Holding the MOVE/EDIT button, drag the object to its new position.

A single object can be implicitly selected and moved by clicking the MOVE/EDIT button in or near it (but not on a vertex or edge) and dragging the object to its new position. The object is automatically deselected after the move.

Multiple objects to be moved simultaneously must all be explicitly selected. The pointer may be initially positioned anywhere, including on any vertex or edge. When moved, the selected objects' relative positions are maintained.

To constrain movement to the horizontal or vertical directions only, hold the **Shift** key down while using the MOVE/EDIT button.

The MOVE/EDIT button's function changes depending on the position of the pointer:

- If the pointer is on or sufficiently near a vertex or edge of a single selected object, an *edit* is performed.
- If the pointer is anywhere else, a *move* is performed.

The distance from a vertex or edge at which an edit, rather than a move, is performed can be specified in the **Setup Design** dialog under the **Selection** tab (see Design Setup on page 1-130).

Incremental Repositioning

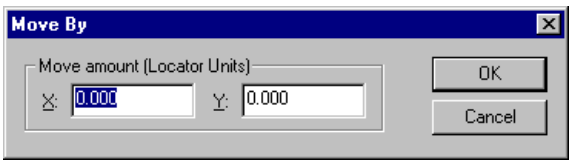
Four commands incrementally move (*nudge*) a selected object or set of objects over a predetermined distance.

Command	*Shortcut*
Draw > Nudge > Left	**Ctrl** + ←
Draw > Nudge > Right	**Ctrl** + →
Draw > Nudge > Up	**Ctrl** + ↑
Draw > Nudge > Down	**Ctrl** + ↓

You can specify the movement increment in the **Nudge amount** field of the **Setup Design—Drawing** dialog (see Drawing Parameters on page 1-145).

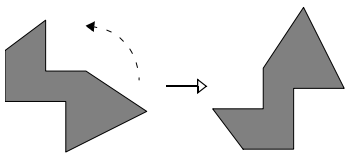
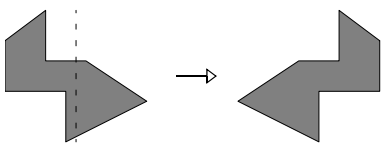
Numerical Repositioning

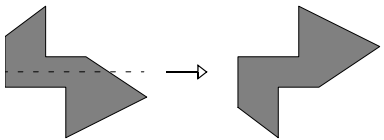
You can move selected objects a specified number of locator units using the **Move By** dialog, which you open by choosing **Draw > Move By**. Enter values for the X and Y directions in the **Move amount (Locator Units)** field and click **OK**.



Reorienting

Three commands change the orientation of selected objects.

Command	*Shortcut*	*Button*	*Description*
Draw > Rotate	**R**		Rotates the selected object 90° counter-clockwise about its geometrical center. 
Draw > Flip > Horizontal	**H**		Flips the selected object about the vertical axis through its geometrical center. 

Command	*Shortcut*	*Button*	*Description*
Draw > Flip > Vertical	**V**		Flips the selected object about the horizontal axis through its geometrical center. 

When multiple objects are selected, the rotation or flip occurs about the geometrical center of the selected group.

Copying and Duplicating Objects

You can copy objects in two ways:

- Choosing **Edit > Copy**, pressing **Ctrl + C**, or clicking the copy button ()
- Choosing **Edit > Duplicate**, pressing **Ctrl + D**, or clicking the duplicate button ()

The copy operation puts a copy of the selected object(s) in the internal clipboard. The copy does not appear in the layout; it must be placed using the paste operation command (see Pasting Objects, below).

The duplicate operation creates a duplicate of the selected object(s) and places it in the active cell, one snap grid point apart from the originals. The new objects are selected and can be moved to a new offset. Subsequent **Duplicate** commands will place duplicates at the same offset from the new originals, aiding in the rapid creation of regular structures like arrays. **Duplicate** does not affect the contents of the internal L-Edit clipboard.

To copy multiple objects simultaneously, you must explicitly select them. (For more information see Explicit Selection on page 1-335.)

Repeated Copying of Objects

When you drag an object made with the **Duplicate** command to a new position, L-Edit keeps track of the object's offset from the original object. If you execute a **Duplicate** command and immediately move the new object, subsequent **Duplicate** operations will create new objects that are automatically offset from the most recently created object by the same amount. You can generate arrays quickly and accurately this way, because every object in the array will have the same position and alignment.

Multiple placement of the same object can be useful in making regularly structured arrays, but it can also result in designs that use a great deal of memory and are difficult to update. Multiple placement of the same object should not be used as a substitute for good hierarchical design using instances.

You can copy or instance of an entire cell, placing the copy or instance in a new cell. See Copying Cells on page 1-378 and Editing Instances on page 1-431).

Copying to the Clipboard

Large areas of the layout can be copied as a bitmap to the external Windows clipboard by choosing **Edit > Clipboard > Copy Window** or **Edit > Clipboard > Copy Selections**. These bitmap images can be pasted into other applications, but they cannot be pasted back into L-Edit. The resolution of the bitmap is the same as that of the screen.

Pasting Objects

L-Edit maintains an internal clipboard that stores cut and copied objects. It can be used to transfer objects between cells or between layers within a file.

Choosing **Edit > Paste**, pressing **Ctrl + V**, or clicking the paste button () places the stored object(s) in the center of the active layout window, unless the **Paste to cursor** feature (see below) is enabled.

Choosing **Edit > Paste to Layer** or pressing **Alt + V** also places the stored object in the center of the layout window of the active cell (unless the **Paste to cursor** feature is enabled). In addition, this command places the object on the layer currently selected in the Layer palette. If you select multiple objects on separate layers, they will all be pasted to the single layer specified with the **Paste to Layer** command. Pasted objects are automatically selected after execution of the paste command.

The contents of the internal clipboard can be pasted multiple times. Objects remain in the clipboard until another object is cut or copied, or until the file is closed.

Note: When you paste an object to a layer, L-Edit will overwrite the object's GDSII data type with the data type of the target layer. If the target layer has no GDSII data type assigned, the pasted object will retain its original data type.

Paste to Cursor Feature

If the **Paste to cursor** box in the **Setup Application—Keyboard** dialog (see Keyboard Customization on page 1-119) is turned on, the contents of the clipboard appear in the layout window but move with the pointer until any mouse button is clicked. The objects are then positioned at the location of the cursor when the paste command is executed. Before clicking the mouse button, you can flip or rotate the objects horizontally or vertically by using the keyboard shortcut commands. (See Reorienting on page 1-360 for a list of default shortcut commands.)

Deleting Objects

You can remove objects from the layout in two ways:

- Choosing **Edit > Cut**, pressing **Ctrl + X**, or clicking the cut button ()
- Choosing **Edit > Clear**, or pressing **Delete** or **Backspace**

The **Cut** command puts the deleted objects into the internal clipboard. From there they can be restored to the current cell or pasted into another cell in the same file (see Pasting Objects on page 1-364).

The clear operation does *not* put the deleted objects into the internal clipboard. They can be restored to the active cell only with the **Undo** command (see Undoing Operations, below).

Undoing Operations

L-Edit maintains a list of edited objects and operations on a per cell basis in the *undo buffer*. Choosing **Edit > Undo**, pressing **Ctrl + Z**, or clicking the Undo button () reverses the last operation performed in a cell. You may continue undoing your operations in reverse order, one at a time, up to and including the first operation on the cell since opening or saving it. L-Edit maintains a separate undo buffer for each cell. Only those operations that directly affect objects—drawing, copying, editing, moving, instancing, grouping, flipping, rotating, slicing, and merging—can be undone.

Undo reverses mouse-based draw, move, edit, and copy operations. It also reverses the following commands:

- **Edit > Cut**
- **Edit > Paste**
- **Draw > Group**
- **Draw > Ungroup**
- **Draw > Rotate**
- **Draw > Flip > Horizontal**
- **Draw > Flip > Vertical**
- **Draw > Slice > Horizontal**
- **Draw > Slice > Vertical**

- **Draw > Merge**
- **Cell > Instance**

The following operations clear the undo buffer:

- **File > Save**
- **File >Save As**
- **File > Replace Setup**
- **Cell > Revert Cell**
- **Cell > Flatten**
- **Tools > Generate Layers**
- **Tools > DRC**

Editing performed prior to any of these operations cannot be reversed with the **Undo** command.

Redo

You can reverse an **Undo** command by choosing **Edit > Redo**, pressing **Ctrl + Y**, or clicking the redo button ().

After an **Undo** operation is performed, the object or operation goes into a *redo buffer*, also maintained by L-Edit on a per-cell basis. After executing an **Undo** command, you can use the **Redo** command to revert the cell to its state before the

Undo command was executed. For example, if you draw a box and then click **Undo**, the box disappears from the layout. Clicking **Redo** causes the box to reappear.

Like the undo buffer, the redo buffer is maintained separately for each cell. The redo buffer is subject to the same guidelines and restrictions as the undo buffer, and it is cleared by the same methods. When editing continues, the redo buffer is cleared.

The depth of both buffers is limited only by computer resources.