A Polygon Pour (brighter red) being used to create a large GND area on a board.

Summary

A polygon pour is a group design object - that is, it is made up of simpler primitive objects. Polygon pours are used to create a solid or hatched (lattice) area on a PCB layer, using either Region objects, or a combination of Track and Arc objects. Also referred to as copper pours, polygon pours are similar to a region, except that they can fill irregularly shaped areas of a board as they automatically pour around existing objects, connecting only to objects on the same net as the polygon pour.

On a signal layer, you can place a solid polygon pour to define an area for carrying large power supply currents, or as a ground-connected area for providing electro-magnetic shielding. Hatched polygon pours are commonly used for ground purposes in analog designs.

Availability

Polygon Pours can only be placed in the PCB Editor. You can place them directly, or create them from selected primitives. To place a polygon:

- Switch to the required layer.
• Click **Place » Polygon Pour.**

**Placement**

After launching the command, the *Polygon Pour* dialog will open:

1. Select the polygon **Fill Mode**, these are discussed in more detail below.
2. Select the required net in the **Connect to Net** drop down.
3. Note that each polygon has a **Name**, a system-defined name will be based on the layer and the net, enter your preferred **Name**.
4. Typically that is all that needs to be set before placement (the other options are discussed in more detail below) - click **OK** to commence defining the polygon shape.
5. Position the cursor and click to anchor the starting vertex for the polygon.
6. Move the cursor ready to place the second vertex. The default behavior is to place 2 edges with each click (as shown in the first 5 images in the set below), with a user-defined corner shape between them. Refer to the **Placement Modes** topic below for more details on changing corner modes.
7. Continue to move the mouse and click to place further vertices.
8. After placing the final vertex, right-click or press **Esc** to close and complete placement of the polygon. There is no need to manually close the polygon as the software will automatically complete the shape by connecting the start point to the final point placed.
Placement Modes

- While placing a polygon there are 5 available corner modes, 4 of which also have corner direction sub-modes. During placement:
  - Press **Shift+Spacebar** to cycle through the 5 available corner modes: 45 degree, 45 degree with arc, 90 degree, 90 degree with arc, and Any Angle.
  - Press **Spacebar** to toggle between the two corner direction sub-modes.
  - When in either of the arc corner modes, hold the 🡱 or 🡰 keys to shrink or grow the arc. Hold the Shift key as you press to accelerate arc resizing.
  - Press the 1 shortcut key to toggle between placing 2 edges per click, or one edge per click. In this second mode the dashed edge is referred to as the look-ahead segment (as shown in the last image in the set below).
  - Press the **Backspace** key to remove the last vertex.

![Images showing corner modes and placing a polygon](image)

Press **Shift+Spacebar** to cycle through the 5 available corner modes, press the 1 shortcut to toggle placement between 2 edges or 1 edge.

Defining a Polygon from Selected Objects

As well as interactively placing a polygon, they can also be created from a set of existing track and arc objects that define a closed shape. To define a polygon from an existing closed shape:

1. Select all primitives that form the closed shape
2. Click **Tools » Convert » Create Polygon from Selected Primitives**.

The polygon will be created with its Fill Mode set to Outline. Note that the original selected primitives are not removed, and the new polygon is poured inside the selected objects. The selected objects can now be deleted or moved to another layer (via the Inspector panel). Double-click to repour the new polygon as solid or hatched. Note that the edge of the new polygon will lie along the centerline of the selected objects that were used to create it.

As the **Create Polygon from Selected Objects** algorithm uses the centerline of the selected
objects, it requires that the end and start locations of touching objects are exactly co-incident (at the same location). If this is not the case a Confirm dialog will appear, giving the location where the algorithm failed, and also providing the opportunity to instruct the algorithm to attempt to define the polygon from the edges of the objects instead. As long as the selected objects overlap slightly this option should create a polygon, with the edge of the polygon tracing the outer edge of the selected objects.

**Graphical Editing**

There are a number of commands available to graphically modify a polygon.

**Move Polygon Vertices**

Polygons contain to points, or "handles" with which to edit the shape of the polygon.

1. **Full Handles** - These filled handles are located at the corners of the polygon.
2. **Empty Handles** - These blank handles are located in the centers of the segments created by the Full Handles.

An existing polygon can be re-shaped by moving these handles, or vertices, located at each corner, or at the center of each edge.

To modify the polygon shape:

1. Click and select a polygon, which will highlight the vertices for the polygon and change the cursor to a crosshair.
   1. Click on a Full Handle to move that corner.
   2. Click on an Empty Handle to break that edge into 2 edges. The Shift+Spacebar hotkeys can then be used to cycle through modes (arc, miter, and any angle).
   3. Click along an edge to move the entire edge.
2. When you have finished, right-click and select **Polygon » Repour Selected** to repour the polygon in its new shape.

**Polygon Pour Cutout**

To create a cutout, or hole inside a polygon you place a polygon pour cutout on top of the existing polygon. To do this:

1. Click **Place » Polygon Pour Cutout**.
2. The cursor will change to a crosshair, starting inside the boundary of the polygon, click the Left Mouse button to define the starting location.
3. Move the cursor across the polygon. The cutout is actually a Region object with the Polygon Cutout option enabled, press Shift+Spacebar to cycle through the region corner modes.
4. Continue to click and move the mouse to define the cutout outline.
5. Right-click to exit polygon cutout placement mode.
6. The original polygon must now be repoured, double-click on the polygon to repour it - it will pour around the new cutout.

The cutout exists as an independent object, it can be moved, resized or deleted if required. Remember that the polygon must be repoured whenever the cutout is changed.
Slice Polygon Pour

An existing polygon can be sliced into 2 smaller polygons, to do this:

1. Click Place » Slice Polygon Pour.
2. The cursor will change to a crosshair, starting outside the boundary of the polygon, click the Left Mouse button to define the starting location.
3. Move the cursor across the polygon. The slicing process uses the Line placement mode to define both the slice path and width, press Tab to change the width, press Shift+Spacebar to cycle through the line placement corner modes.
4. Continue to click and move the mouse to define the slice path.
5. Once the slicing line has been placed across and out the other side of the polygon, right-click to terminate line placement.
6. Right click a second time to terminate slicing, when you do a Confirm dialog will appear asking if you wish to split the polygon into 2, click Yes to split it.
7. A second Confirm dialog will appear asking if you wish to rebuild 2 polygons, click Yes to rebuild the 2 new polygons

As these are now 2 independent polygons, each can be edited and repoured as required.

As the slicing line is the same color as the polygon, it helps if the polygon is repoured with the Fill Mode set to outlines before starting the slicing process, so the slicing line can easily be seen.

If attempting to graphically modify an object that has its Locked property enabled, a dialog will appear asking for confirmation to proceed with the edit. If the Protect Locked Objects option is enabled on the PCB Editor - General page of the Preferences dialog, and the Locked option for that design object is enabled as well, then that object cannot be selected or graphically edited. Double click on the locked object directly and disable the Locked property or disable the Protect Locked Objects option, to graphically edit the object.

Non-Graphical Editing

The following methods of non-graphical editing are available:

To select or edit a polygon, first switch to the layer that the polygon is on.

Via an Associated Properties Dialog

*Dialog page: Polygon Pour*

This method of editing uses the following dialog to modify the properties of a polygon pour object.

The Polygon Pour dialog can be accessed prior to entering placement mode, from the PCB Editor -
Defaults page of the Preferences dialog. This allows the default properties for the polygon pour object to be changed, which will be applied when placing subsequent polygon pours.

During placement, the dialog can be accessed by pressing the Tab key.

After placement, the dialog can be accessed in one of the following ways:

- Double-clicking on the placed polygon pour object.
- Placing the cursor over the polygon pour object, right-clicking and choosing Properties from the context menu.
- Run command Edit » Change, then click an existing object.

Polygon Fill Modes

The polygon pour placement engine can construct polygons from either: solid regions, or from a combination of tracks and arcs. To help you decide which of these to use, consider the following:

- **Region** based polygons result in far fewer objects being placed, making for: smaller files; faster redraws, file opening, DRC and net connectivity analysis; and smaller output files as the region object is fully supported in Gerber and ODB++
- **Track/Arc** based polygons allow a hatched polygon to be created, by setting the Track Width to be smaller than the Grid Size. Note that they can also be solid by setting the Track Width to be larger than the Grid Size.
- **Outline Only** polygons are simply Track/Arc polygons without the internal tracks and arcs.

![The same Polygon, poured using regions, then poured using tracks/arcs.](image)

Remove Islands Less Than

Remove any areas of copper that are less than the specified area. This option is area-based only, it does not consider if that island is connected to a pad or via. Note that all small unconnected areas of copper are always removed if the Remove Dead Copper option is enabled.

Arc Approximation

In a region-based polygon circular holes are approximated by a series of straight edges, reducing this value will result in a larger number of straight edges being used to give a better approximation of an arc.

Remove Necks When Copper Width Less Than

Use this to remove narrow slithers of copper. Note that when this option has a larger value there will be a greater number of tight locations where the polygon cannot pour. The value should not be smaller than the narrowest track width that the fabricator can support, as a guide it can be set to be the same as the narrowest track width used on the board.
Net Options

The Net Options includes a drop down with the following 3 options:

- **Don't Pour Over Same Net Objects** - pour the polygon in free space only.
- **Pour Over All Same Net Objects** - pour the polygon in free space and also pour over any objects that belong to the same net (tracks, arcs, fills, regions, other polygons).
- **Pour Over Same Net Polygons Only** - pour the polygon in free space and also pour over existing polygons that belong to the same net.

Remove Dead Copper - if this option is enabled any area of polygon that does not include at least one connection to another net object (such as a pad or via) is automatically removed. Note that if your polygon does not enclose any pads on the assigned net, then it is all dead copper and will all be removed. In this situation the outline of the polygon is still shown to indicate that a polygon exists in this location.

Hiding and Restoring Polygons (Shelving and Unshelving)

To perform design tasks within a polygon, such as repositioning a component or moving routing, the polygon can be Shelved. Shelving a polygon does not remove it from the design, it is simply hidden from display and the DRC and net connectivity analysis engines.

- To shelve a polygon click **Tools » Polygon Pours » Shelve Polygons**.
- To restore a shelved polygon click **Tools » Polygon Pours » Unshelve Polygon**.

Repouring Polygons

If you have changed the design within a polygon, once it has been restored it will need to be repoured to clear any violations created by the design changes. To repour polygons:

- Click the appropriate **Repour** command **Tools » Polygon Pours » Repour Polygons**.

Editing via an Inspector Panel

Panel pages: **PCB Inspector, PCBLIB Inspector**

An Inspector panel enables the designer to interrogate and edit the properties of one or more design objects in the active document. Used in conjunction with appropriate filtering, the panel can be used to make changes to multiple objects of the same kind, from one convenient location.

Editing via a List Panel

Panel pages: **PCB List, PCBLIB List**

A List panel allows the designer to display design objects from one or more documents in tabular format, enabling quick inspection and modification of object attributes. Used in conjunction with appropriate filtering, it enables the display of just those objects falling under the scope of the active filter – allowing the designer to target and edit multiple design objects with greater accuracy and efficiency.