

## Grids and Units

Modified by Jason Howie on Oct 9, 2014

Parent page: [Commands](#)

IMAGE

CAPTION

### Summary

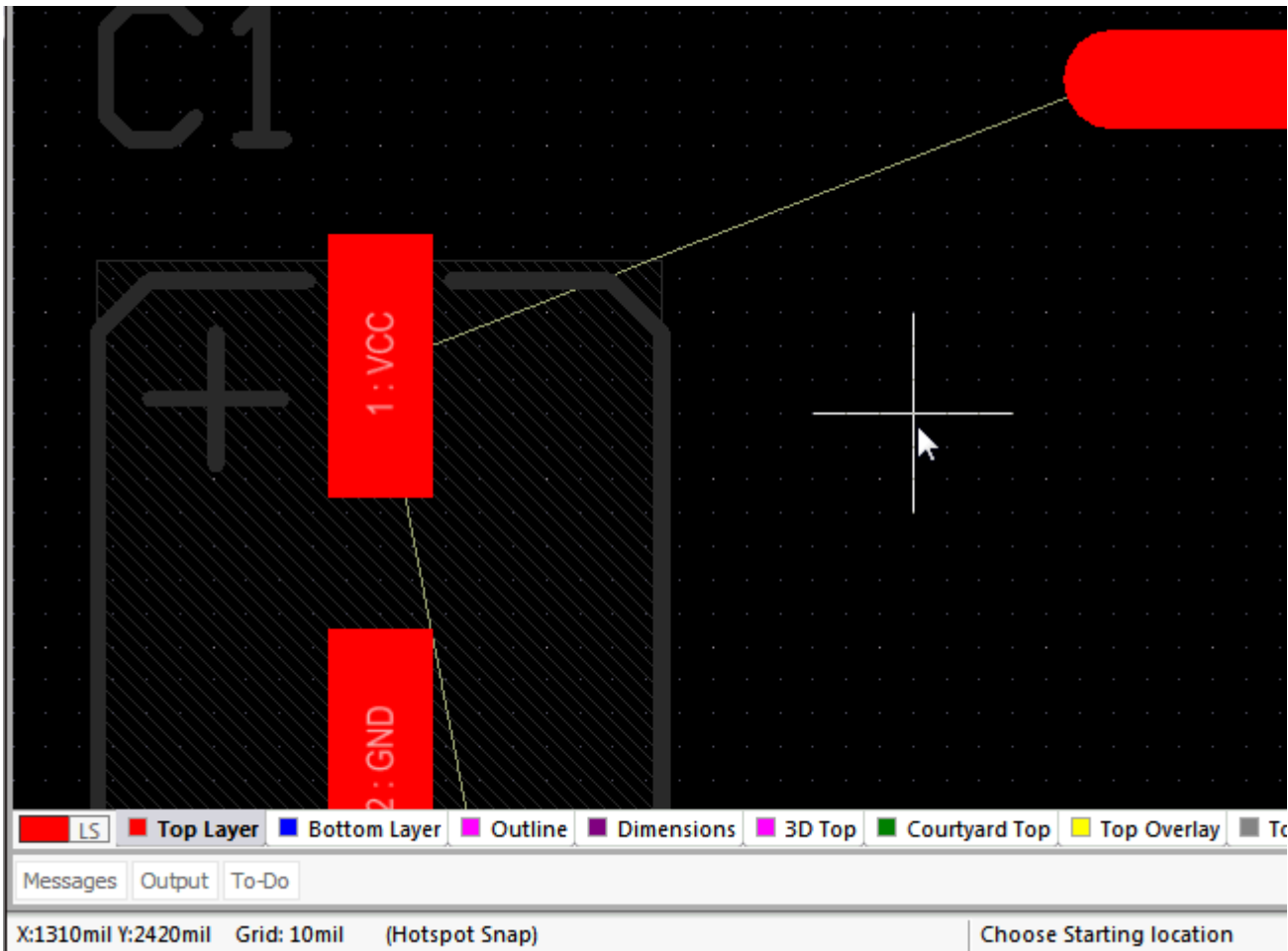
The PCB editor is a grid-based design environment, objects are placed onto the current grid, which is referred to as the *Snap Grid*, or often just called the *Grid*. During object placement, the cursor automatically snaps to this grid, positioning the reference point of the object being placed onto the nearest Snap Grid location. In the early days of electronic product development, component pins were always spaced at multiples of 0.1 inch, making it easy to select a suitable grid for both placing components, and routing tracks between their pads. Today's components can have very fine pins positioned on an imperial or a metric grid, and there is an ever-increasing demand for smaller product packaging - driving the width of tracks and their clearances down to just a few mils. These requirements make it impossible to choose a single snap grid that all pins and routing can be placed on - instead the design tools must allow the designer to route into and out from off-grid component pins - in essence, the designer needs to be able to route gridless.

### Details

These challenges are resolved by changing the approach of the design software. Rather than a simple focus of keeping all objects on a fixed snap grid, the PCB editor has a more sophisticated solution, delivered through the following set of features:

- **Snap Grid** - controls the basic placement of objects in the workspace.
- **Real-time Design Rules engine** - alerts or prevents objects being placed in violation of applicable design rules. Refer to the [Design Rules](#) page to learn more about rules.
- **Hotspot Snap** - pulls the cursor to an existing electrical hotspot that is within the current Hotspot Snap Range, overriding the snap grid, while still obeying the applicable design rules.

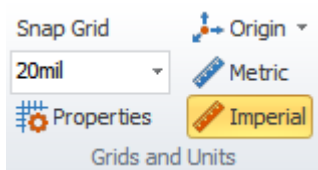
The animation below gives a demonstration of how these features work together. Keep an eye on the Status bar to see the hotspot snap being temporarily disabled. For this demonstration the hotspot snap has been set to a very large value of 50mils, to exaggerate the Hotspot Snap behavior.



Routing is initially constrained by the snap grid, as the route approaches the lower pad on a different net (GND) the rules engine clips the route to prevent a violation, as the route approaches a same-net pad the hotspot snap pulls it to the pad center. Hold the Ctrl key to temporarily inhibit the hotspot snap.

## Setting the Snap Grid

In the PCB editor, all objects are placed on the current Snap Grid. The current Snap Grid value is always displayed on the Status bar (shown in the animation above), next to the current cursor location.



Configure the Snap Grid, Origin and current Workspace Units via the Home tab of the Ribbon.

To set the Snap Grid:

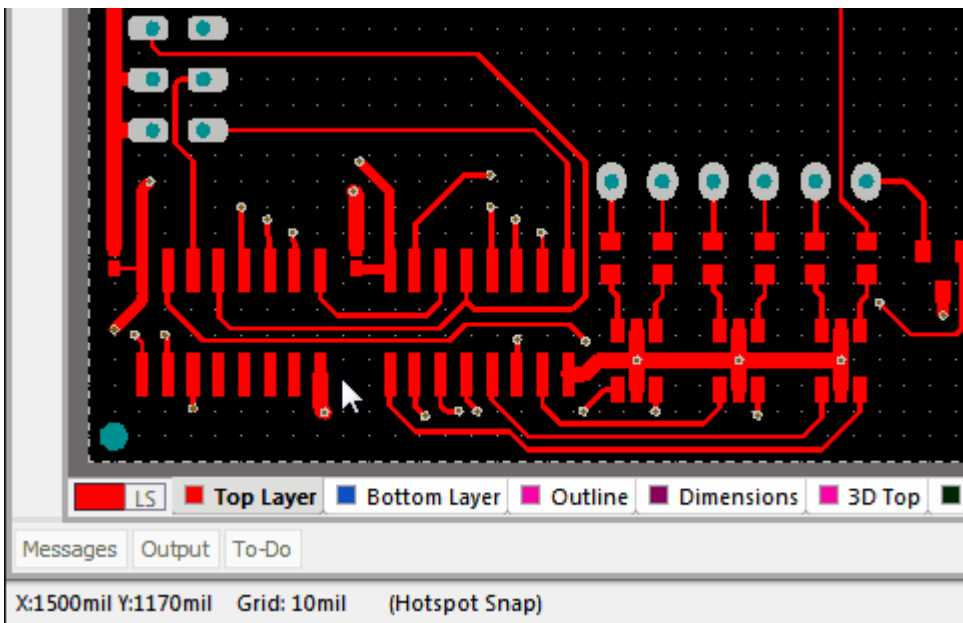
- Click the **Home | Grids and Units | Snap Grid** drop-down on the Ribbon, and select a new grid value. See the note below about using different units.
- Click the **Home | Grids and Units | Properties** button to open the *Cartesian Grid Editor* dialog where a new grid value can be selected from the drop-down, or typed in to the **Step X** field. Refer to the [Cartesian Grid Editor](#) page for more information on this dialog. See the note below about using different units.
- **Ctrl+G** - to open the *Cartesian Grid Editor* dialog, even when currently executing a command.

Refer to the [Cartesian Grid Editor](#) page for more information on this dialog. See the note below about using different units.

- **Ctrl+Shift+G** - to open the *Snap Grid* dialog, type in the required value. Include the units to define the grid *and* to switch the current workspace units (this is how it works in AD).
- Right-click - and select the required grid value from the **Snap Grid** sub-menu.

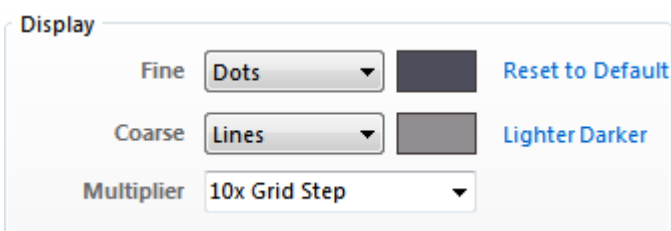
Although you can select or enter a Snap Grid value with different units from the current workspace units in the Ribbon or the *Cartesian Grid Editor* dialog, doing this will not change the workspace units, the software will convert the value you selected/entered into the current units.

## How the Grid is Displayed



The Snap Grid can display as lines or dots.

The Snap Grid is displayed on screen as either a pattern or dots or lines, both are shown in the animation above. There are actually 2 layers used to display the Snap Grid, one that shows the grid as it is set, referred to as the **Fine** grid in the *Cartesian Grid Editor* dialog, the other showing multiples of the Snap Grid, which can be user-defined in the **Multiplier** to be 2x, 5x, or 10x the Snap Grid, which is referred to as the **Coarse** grid in this dialog.

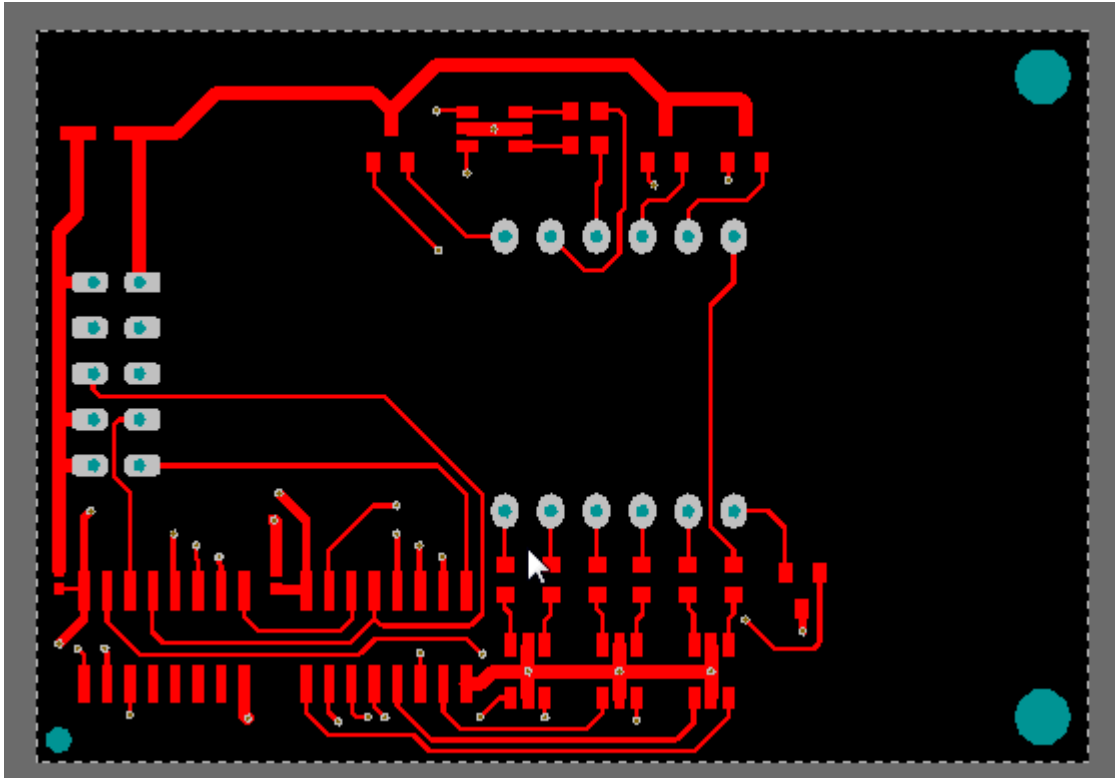


Fine is the Snap Grid, Coarse is a multiple of the Snap Grid.

As well as selecting between Dots or Lines, you can also set the color of the grid layers in the *Cartesian Grid Editor* dialog. Overall on/off control of the display of the two grid layers is performed in the *View Configurations* dialog, press **L** to open it. You can also set the color used for these two layers

in the *View Configurations* dialog.

Note that the display of the grid lines/dots is also a function of the zoom level, they are not shown at all once they become too close together, as shown in the animation below. Zoomed out, no grid lines/dots are shown, as you zoom in the **Coarse** grid lines appear. As you continue to zoom in the dots appear, showing the grid locations of the **Fine** grid.



As you zoom in the Coarse grid is shown first, then the Fine grid. Use **PageUp/PageDown** or **Ctrl+Roll** to zoom in/out.

relationship to board shape

### Choosing a Grid

Regardless of the pitch of the component pins, it is still important to select a sensible Snap Grid. The value you choose will change depending on the design task being performed, for example a coarse grid, such as 1mm or 50mils, could be used for component placement, making it easy to align components relative to each other, while a finer grid would be set for routing that design.

For routing, you typically set the grid to the sum of the standard signal track width + the standard clearance. For example, if the signal tracks are 10mil and the default clearance is 10mil, then a sensible grid would be 20mil. This allows for tracks to be placed as close as possible. Now you're probably thinking, "*but you said I don't have to worry, the rules engine will prevent tracks being placed too close, so I can set the grid very small and just route!*", that is correct, but it won't check to see if you have wasted space, as you would if you used a 25mil Snap Grid. While you can define a finer Snap Grid, it will not necessarily help as you might end up placing your first route slightly out, blocking potential routing paths on either side that you could have used later.

### Setting the Workspace Units

The current workspace units are shown on the Status bar, for both the current current cursor location and the current snap grid setting.

To toggle the current workspace units between imperial and metric:

- Click the **Home | Grids and Units | Imperial** or **Metric** button on the ribbon.
- Press the **Q** shortcut, this can be done at any time (while executing a command, or not).
- While editing in an object dialog, press **Ctrl+Q** to toggle the units in that dialog - note that this does not change the workspace units, it only applies to the current use of the dialog.

Whenever you toggle the current workspace units, the current Snap Grid is converted. For example, if the Snap Grid was 10mils, when you press Q the Snap Grid will become 0.254mm.

## Hotspot Snap

Complimenting the real-time design rule engine, the Hotspot Snap feature overrides the snap grid, pulling the cursor to the hotspot of an electrical object that is within the hotspot snap range. This feature allows you to route from or to off-grid pads and vias.

How is this set, does the board options dialog remain or will it be done via the ribbon???

IMAGE

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When Hotspot Snap is enabled it is shown on the Status bar. Hold **Ctrl** while moving an object on the cursor to temporarily inhibit the hotspot snap.

## Real-time Design Rules

Underlying the PCB editor is a Design Rules engine that monitors editing actions in real time. Rather than needing to rely on a suitable snap grid setting to ensure objects are placed so they meet the design requirements, the rules engine immediately highlights a placement violation, or in the case of interactive routing, can prevent a placement violation. That means the snap grid can be set very small and objects placed as close as the design rules allow.

Refer to the [PCB Design Rules Reference](#) to learn more about design rules.

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### Source URL:

[http://documentation.circuitmaker.com/display/CMAK/PCB\\_Cmd-GridsnUnits\\_Composite\(\(Grids+and+Units\)\)\\_CM](http://documentation.circuitmaker.com/display/CMAK/PCB_Cmd-GridsnUnits_Composite((Grids+and+Units))_CM)