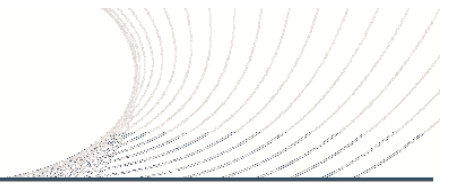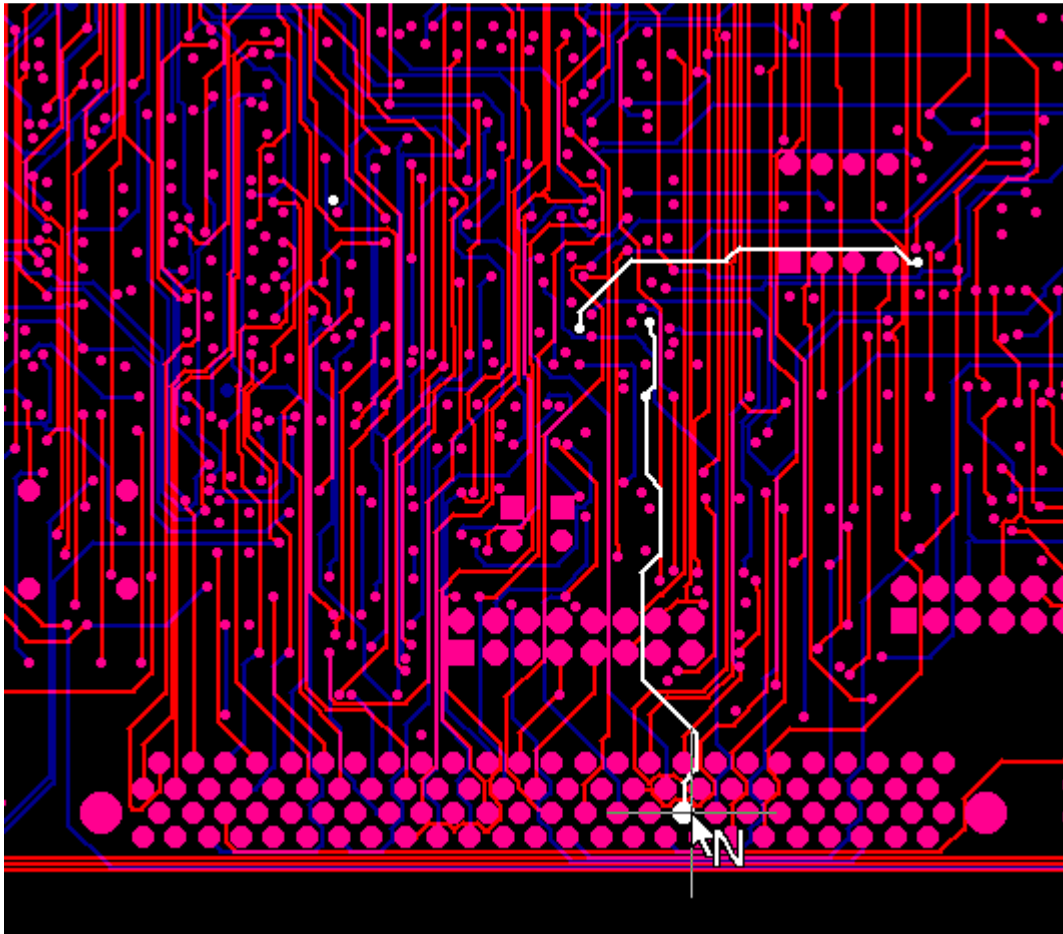# Selecting Connected Copper Using ViewMate Pro

Available in version 10.6 and up

Introduction

A powerful new feature is now available to ViewMate Pro users. Introduced in version 10.6, the feature is called "Select Electrically Connected Elements". Using this new tool you can quickly see how your data is connected. For example, consider the image shown below:
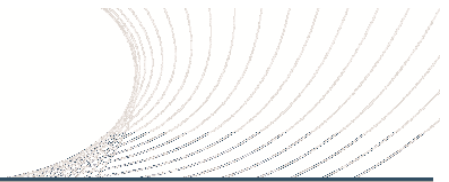

Figure 1 – Use the new tool to quickly highlight all electrically connected elements.

After the tool is activated, you can click on any electrical element. All other visible electrical elements that are connected to the same element you clicked on will become highlighted. This makes it really easy to see how a particular net is connected. If you need to edit your Gerber/Drill data, then this is a tool you will use a lot.

This application note gives you a brief introduction to the new feature. This feature is also available in CAMMaster. This application note will demonstrate the new feature utilizing ViewMate Pro.

To use the new tool, you will need to know how to set up your "Layer Types" and your "Selection Criteria". We'll discuss layer types first and then give a brief introduction to setting up your selection criteria. Once you understand these two concepts, you'll be ready to use the new feature.

Setting up Layer Types

Before you can use the new tool, you must assign the "Layer Types" of each of your layers of interest. ViewMate Pro must know which layers you want to include when selecting the electrically connected elements. Note, that in general, this is a good practice to follow anyway. ViewMate Pro can do more for you if you set the layer types appropriately.

Layer Types

Most PCB designs have certain layers in common. For a double sided board, you'll always have both a top and a bottom copper layer. For multilayer boards you'll also have a number of internal layers. Most boards usually also contain top and bottom SolderMask and top layer SilkScreen. Some boards also contain SilkScreen on the bottom layer. Another layer that affects electrical connectivity is the "Plated Drills" layer.

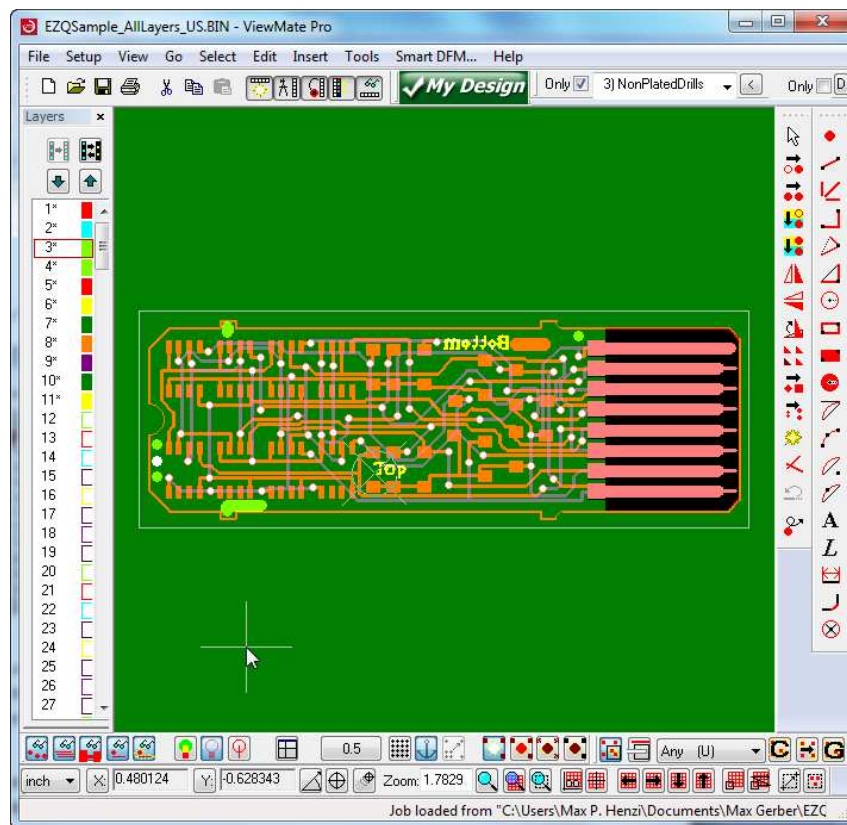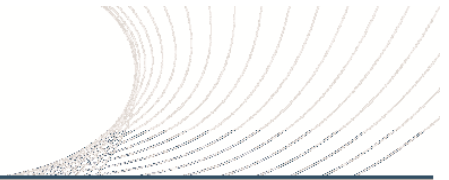We will use a very simple example to demonstrate layer types. The design is shown in the figure below:

Figure 2 – Sample file used to demonstrate "Layer Types"

This is a two layer board that contains all of the layer types that you are likely to encounter when working with traditional boards. If your design contains blind and/or buried vias, then your layer setup needs to be prepared differently. This is beyond the scope of this application note. If you have questions about setting up a job with blind and/or buried vias, please contact PentaLogix Technical Support for further information.

The "Layers Table"

Press the "F10" key to display the "Layers Table" as shown below:

Figure 3 – "Layers Table"

Note that this simple design only contains two copper layers. However, there are a total of 11 layers in the design. Note the "Type" column that is highlighted above. This column defines the "Layer Type" for each of the loaded layers. Our design contains the following layer types:

Board Outline (BOL)

The board outline is shown on layer 1. Ideally, this should be a single continuous (unbroken) outline that describes the outline of your PCB. The board edge is described by the centerline of the elements on this layer.
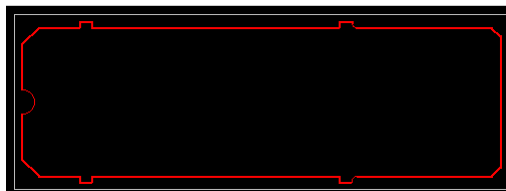

Figure 4 – Board Outline – Layer Type is "BOL"

Plated Drills (PTH)

The "Plated Drills" layer is shown on layer number 2. This layer should contain all of the "Plated" drill information for your design. The plated drill layer contains holes that are "plated through" from the top layer to the bottom layer. Any elements on any of the electrical layers that connect to these holes will be connected together. Ideally, the plated drills layer should be set to "PTH" (Plated Through Hole), although a more common setting of "DRI" (Drill) will also work.
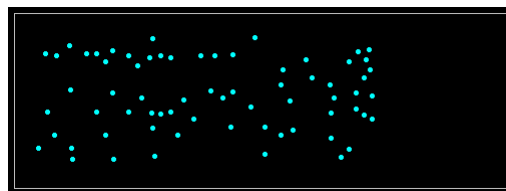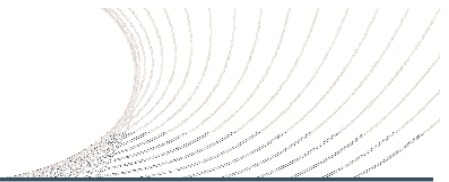

Figure 5 – Plated Drills – Layer Type is "PTH" or "DRI"

NonPlated Drills (NTH)

The "NonPlated Drills" layer is shown in layer number 3. This layer should contain all of the holes that are not plated. Since the holes are not plated, they cannot be used to connect elements on different layers. In fact, you should ensure that any elements on the copper layers maintain a minimum distance away from these non plated holes.

Figure 6 – NonPlated Drills – Layer Type is "NTH"

Note that many CAD systems will place both the "Plated Drills" and the "NonPlated Drills" in the same layer (typically with a ".dri" extension). However, we consider this to be a bad idea. Most drill formats (Excellon for example) do not differentiate between plated and non plated types. The plated drills and the non plated drills are drilled at different times during the PCB fabrication cycle. The plated drills are drilled before the PCB is plated and the non plated drills are drilled after plating. It is necessary to separate these two drill types. If you don't do it, then your PCB fabricator will need to perform this extra step. It is our recommendation that you separate the plated and the non plated drills into separate layers as shown in this design. If you do not separate the plated and non plated drills into different layers, then you must at least ensure that the "Tool Code Type" is set correctly as shown below.


Figure 7 – Tool Codes menu – You can access by pressing "Shift+F5"

Plated Internal Routs (RPI)

The Plated Internal Routs layer is shown on layer number 4. Most likely, your design won't contain this layer type. However, if you have plated through cutouts that you want to include in your design, then you should place them on a separate layer and set the layer type to "RPI" (Rout, Plated, Internal). Note that any elements on different layers that contact RPI elements will be electrically connected. However, at the present time, ViewMate Pro does not take these layers into account.

Figure 8 – Plated Internal Routs – Layer Type is "RPI"
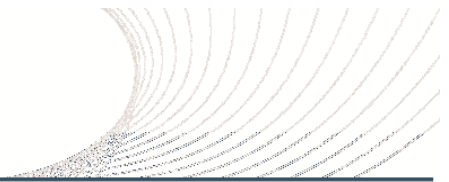
NonPlated Internal Routs (RNI)

The NonPlated Internal Routs layer is shown on layer number 5. Again, this layer type is not very common. However, if you have irregular shaped cutouts (or even large circular cutouts), then the PCB manufacturer is likely going to create these cutouts using a "router" instead of a drilling machine. We recommend that any shapes defining these cutouts are placed on a separate layer and that you assign a layer type of "RNI" (Rout, NonPlated, Internal).
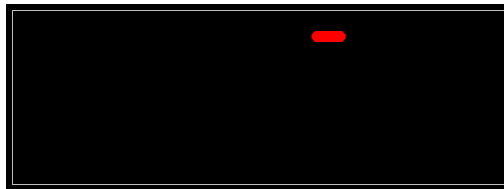

Figure 9 – NonPlated Internal Routs – Layer Type is "RNI"

Top SilkScreen (SKU) and Bottom SilkScreen (SKL)

The top SilkScreen layer is shown on layer number 6 and the bottom SilkScreen layer is shown on layer number 11. Most often, these layers are used to define where legend ink is placed on the board to identify component outlines and component identifiers (R1, C2, U10, etc.). The legend ink is not electrically conductive. By setting the layer type to "SKU" and/or "SKL", you tell ViewMate Pro that this is a SilkScreen layer and to ignore it when determining electrical connectivity.

Figure 10 – Top SilkScreen (SKU) and Bottom SilkScreen (SKL)

Top SolderMask (MSU) and Bottom SolderMask (MSL)

The top SolderMask layer is shown on layer number 7 and the bottom SolderMask layer is shown on layer number 10. These layers are used to identify areas where you don't want solder to adhere to the PCB. The SolderMask material that is applied is not electrically conductive. By setting the layer type to "MSU" and /or "MSL", you tell ViewMate Pro that this is a SolderMask layer and to ignore it when determining electrical connectivity.
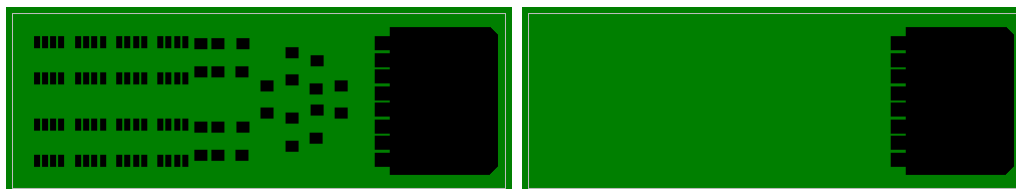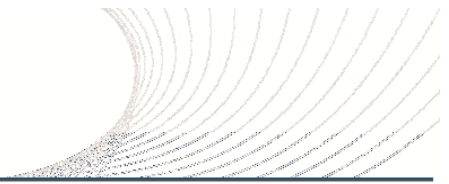

Figure 11 – Top SolderMask (MSU) and Bottom SolderMask (MSL)

Top Copper (CPU) and Bottom Copper (CPL)

The top copper layer is shown on layer number 8 and the bottom copper layer is shown on layer number 9. These layers contain the outer layer electrical elements that will remain as copper features after the PCB is etched. Set the top copper layer type to "CPU" (Copper, Upper) and the bottom copper layer type to "CPL" (Copper, Lower).
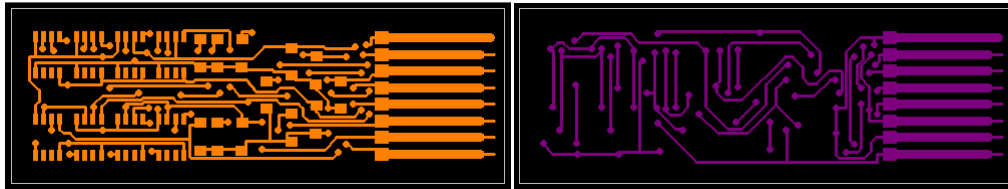

Figure 12 – Top Copper (CPU) and Bottom Copper (CPL)

Internal Layers (SIG)

Our example does not contain any internal layers. We recommend that you set the layer type of any internal layers to "SIG". ViewMate Pro considers all elements on "SIG" layers to be electrically conductive and will take these elements into account when determining electrical connectivity.

Summary

It takes only a few moments to set your "Layer Types" correctly. By taking the time to set up your layer types you will save yourself time when using other features within ViewMate Pro. Setting up these layer types will also make it easier for you to use the data in our EZPCBQuote software.

The following layer types are considered "conductive" types:
SIG, CPU, CPL, DRI, PAD, PTH, VIA, VID and all power and ground plane layer types. If you have any layers that are "work layers" and that do not fit into any of the previously discussed layer types, then set them to "OTH" or "NFL" so that they are ignored.

Selecting Elements

There are many occasions when you will want to select one or more elements. When you activate the selection tool (shortcut key is "S"), you can select individual elements by clicking near them. You can select multiple elements by dragging a window around the elements while the selection tool is active. You can also globally select all visible elements that match your selection criteria by pressing the "V" key or by selecting "Select->Global->New".
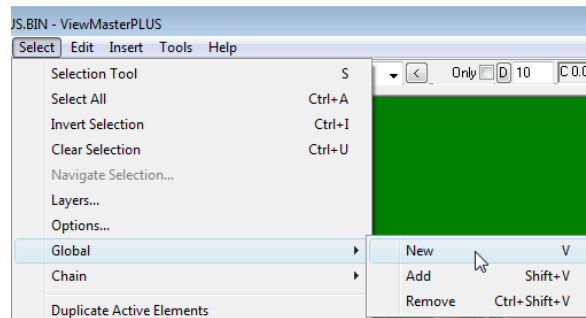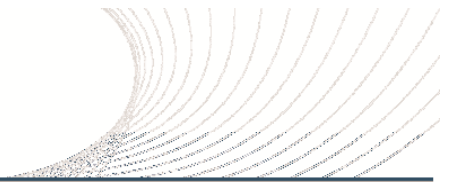
Figure – 13 – Global Selection

Setting Up Your Selection Criteria

ViewMate Pro makes selections based upon how you set up your selection criteria. This feature is also useful when using the new "Select Electrically Connected Elements" tool. Note the four highlighted sections in the figure below:
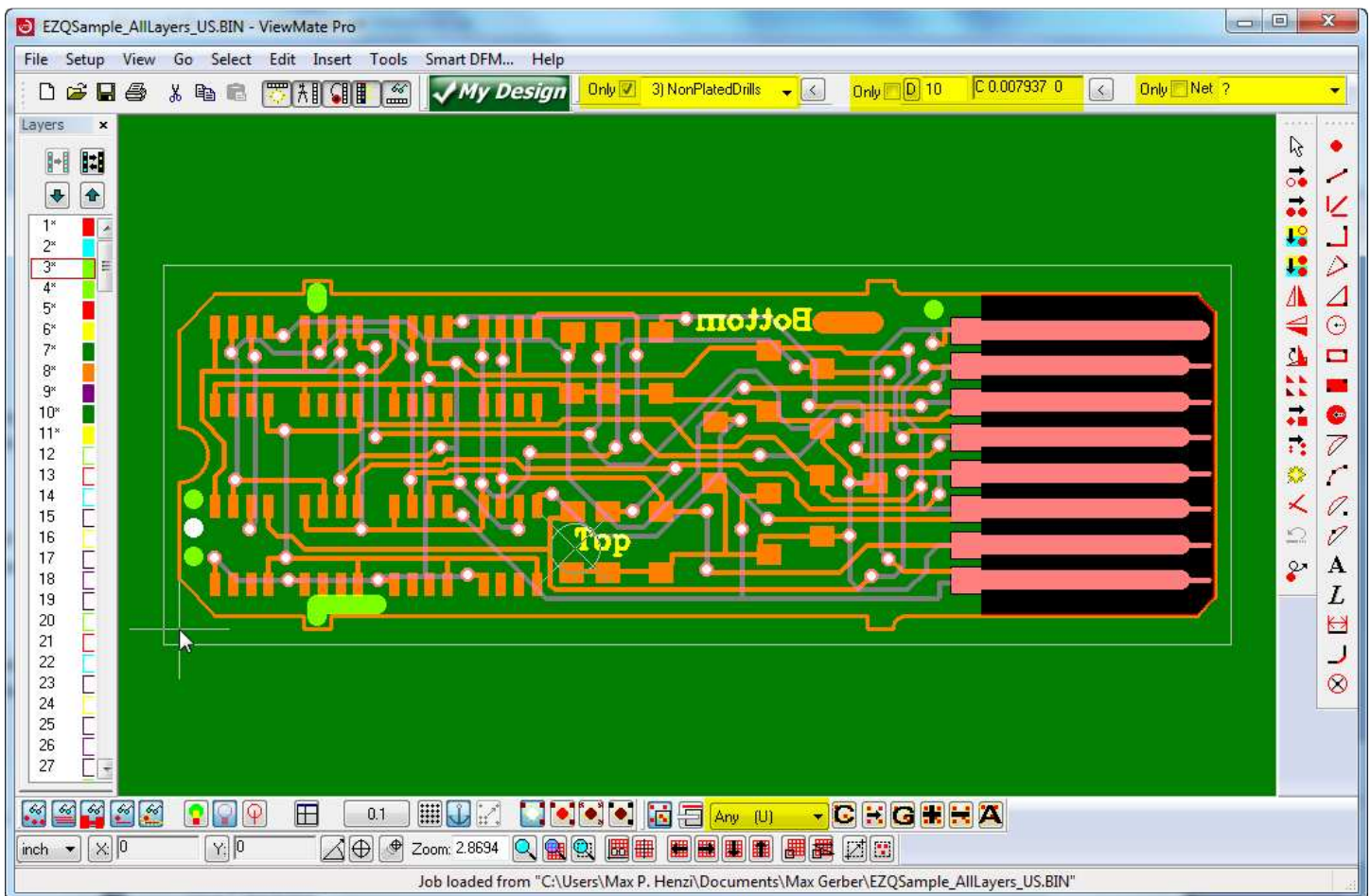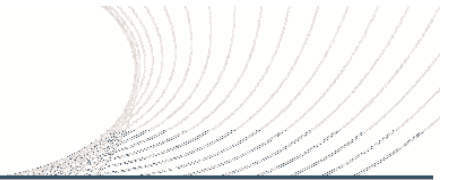

Figure 14 – Notice the four "Selection Criteria" controls

Only Current Layer

You can instruct ViewMate Pro to select only elements on the currently selected layer by checking the "Only Current Layer" check box.
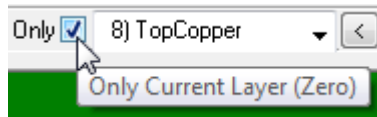
Figure 15 – "Only Current Layer"

Only Current D Code

If this check box is checked, then ViewMate Pro will select only elements that match the indicated D Code.
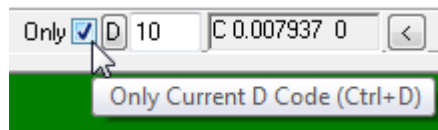

Figure 16 – "Only Current D Code"

Only Current Net

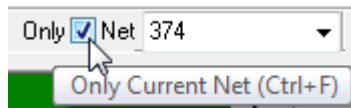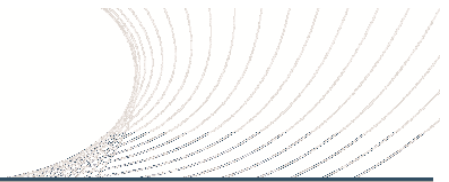If this check box is checked, then ViewMate Pro will select only elements that match the current Net Number.

Figure 17 – "Only Current Net"

Selection Criteria Combo Box

You can further condition your selection criteria by making a selection from the selection criteria combo box as shown below. For example, if you choose the "Pads" item, then only elements that are mapped to pads in your file will be selected. Click on the "Any" item if you don't want to have the "Selection Criteria Combo Box" affect your selections.
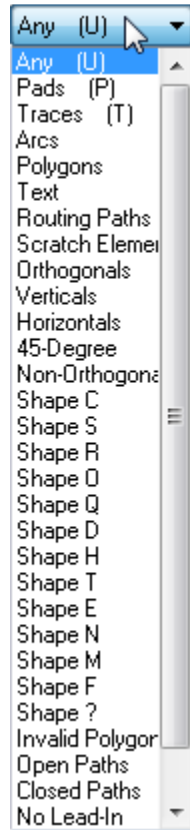

Figure 18 – "Selection Criteria" Combo Box

How Selection Criteria Works

Note that your final selection criterion is determined by taking each of the four items mentioned above into account. For example, if you set your selection criteria as follows:
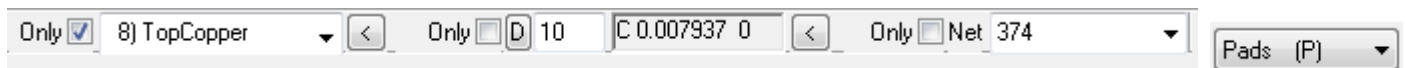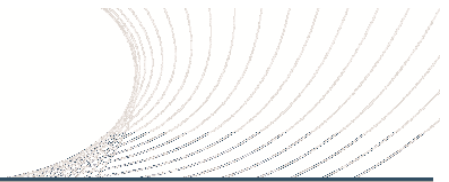

Figure 19 – Selection Criterion Example

When you perform a selection, only pads on the "Top Copper" layer will be selected.

Notice also, that in addition to your selection criterion, only visible elements will be selected. For example if you want to select only elements on the outer layers, then turn only these layers on and uncheck the "Only Current Layer" check box.

Using the "Select Electrically Connected Elements" Tool

After you've set up your layer types and your selection criterion, you're ready to use the new feature. Make the layers that you want to review visible. Then, select "Tools->Netlist->Select Electrically Connected Elements" as shown below:
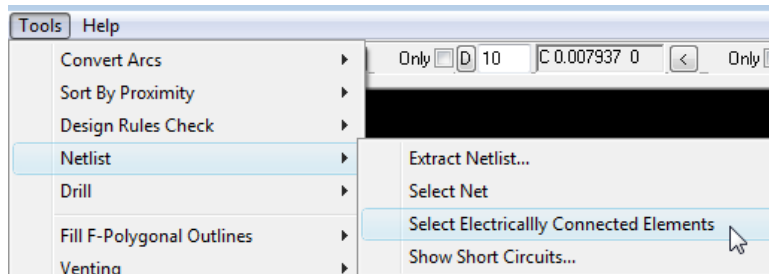

Figure 20 – Select Electrically Connected Elements

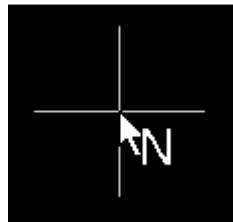In response, the cursor shape will change as shown below:

Figure 21 – "Select Electrically Connected Elements" cursor

Move close to a desired element and click the left mouse button. ViewMate Pro will highlight all of the elements that connect to this element.
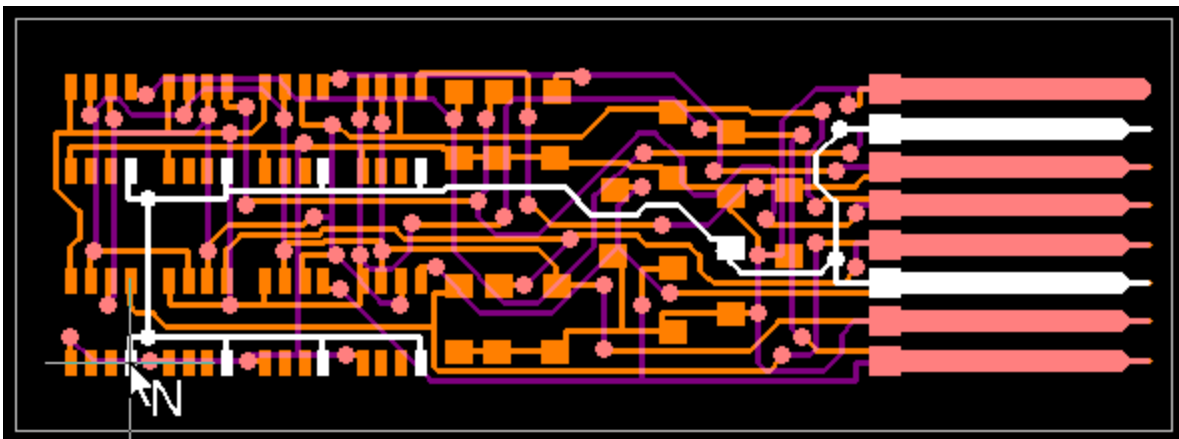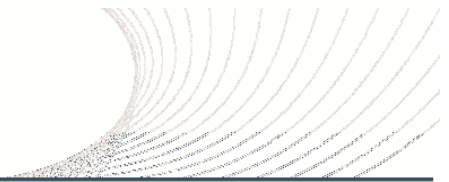

Figure 22 – Click to show all electrically connected elements

Handling Negative and Mixed Mode Layers

Note that the new feature works correctly even if you have data that contains negative layers or layers composed of multiple paint and scratch elements. For example, consider the ground plane layer shown below:
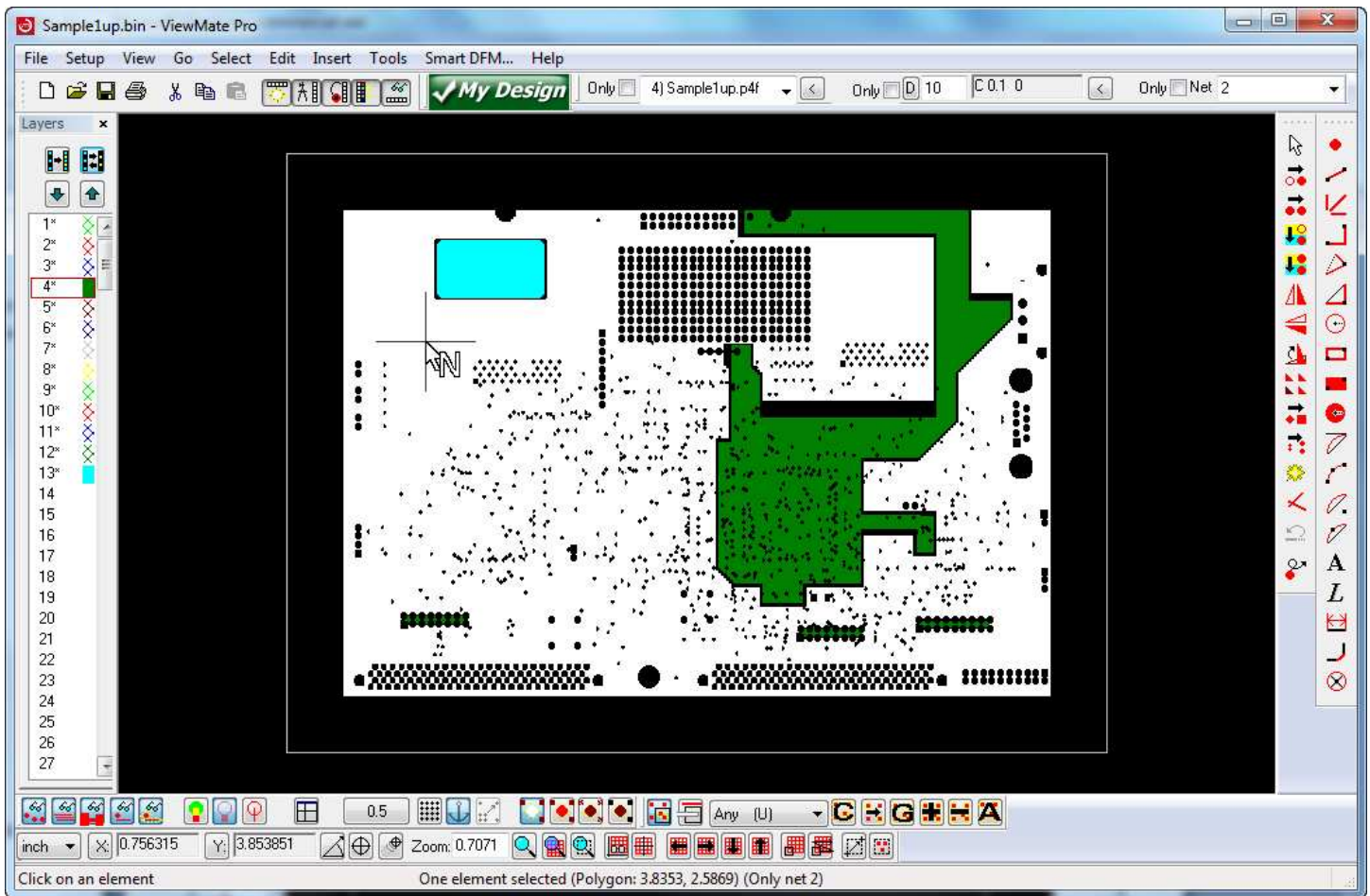

Figure 23 – Negative and/or Paint and Scratch data is handled automatically

ViewMate Pro will temporarily convert all of the data to polygons in order to calculate the electrically connected elements. You will not lose your original data structure when using this new feature. ViewMate Pro will automatically restore your original data when you are finished using the tool.

Editing Restrictions

Please note that while the new feature is active, you will receive a warning if you try to edit the data in any way:
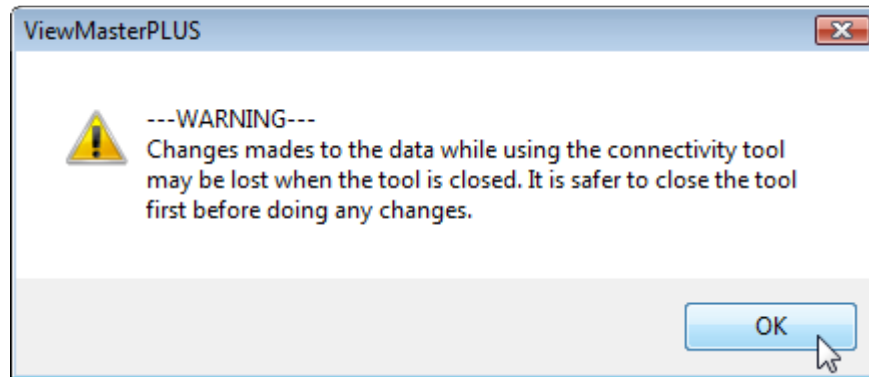

Figure 24 – You should not edit data while the new feature is active

As mentioned previously, all of the data is converted to polygons when the new feature is active. Your original data will be restored when you dismiss the "Select Electrically Connected Elements" feature. Any edits that you make while the new feature is active will be discarded.

Summary

We hope that you enjoy this powerful new feature. As always, we welcome your feedback. Please direct any suggestions to support@pentalogix.com.

The PentaLogix Team