Netlist Analyzer: Tutorial 3
How to find Netlist Violations

Introduction

The Netlist Analyzer is a graphic viewer for generating and comparing netlists during a job cycle.

This tutorial is the third in a series of tutorials which describe how the Genesis Netlist Analyzer works. The first tutorial explained the basic terms and concepts required for understanding the Netlist Analyzer. The second tutorial explained the basic operations of the application. This tutorial describes the typical workflow when using the Netlist Analyzer and gives tips about how to find shorts and breaks.

These tutorials have been designed to enable you to sit at your computer with Genesis and work through the tutorials at your own pace.

NOTES:

1. Information not contained here can be found in the on-line documentation: see Doc. 0506 The Netlist Analyzer, Doc. 0107 Analysis Training Tutorial and Release Notes.

*2. This tutorial uses the Job **demo_design**. (This job is called **netanalj1** in the tutorial). If you do not have access to this job, see the Appendix of this tutorial for a description about how to download it using FTP via the internet.*

When reading this tutorial there are a few symbols found on the left side of the page to help you navigate.

Symbol	Description
	**Note**: This explains an important point or provides reference to further information.
	**Information**: This is a section where you learn about a specific topic.
	**Action**: This is a section where you actively work with Genesis.
	**Tip**: This provides suggestions of how to work more effectively.
	**Question**: This is something for you to think about.

Objectives

In this tutorial you will learn about:

- The typical Netlist Analyzer workflow
- Some tips about how to start detecting violations
- Finding a short using automatic short highlight
- Understanding a short
- Turning off the shapes filter to see the original CAD Netlist
- Fixing a short
- Finding a short manually without using automatic highlight
- Setting the color contrast between nets
- Understanding the Netlist Analyzer graphic display
- Checking a short manually when you cannot use automatic highlight
- Locating and fixing shorts between P&G layers
- Understanding a break violation
- Understanding Extra reports
- Tips for finding problems with the CAD Netlist.

Tutorial

The Typical Netlist Analyzer Workflow

This section describes the typical Netlist Analyzer workflow and the rationale behind each step. This information should help you better understand the concepts behind the Netlist Analyzer in order to utilize it effectively.

Step 1: Generate a CAD Netlist

This action does not do a calculation but simply takes the CAD netlist exactly as it was provided from input (e.g., IPC file) and enables you to display CAD points and nets. The net names will be identical to the names defined in the CAD Netlist file which enables you to communicate with your customer.

STEP 2: GENERATE A CURRENT-BASED CAD (CBC) NETLIST

The primary use of this netlist is to perform the initial comparison between the CAD Netlist file and the Gerber/drill graphical data. Actually we can compare the CAD Netlist to the Current Netlist (which takes as net points all outer layer pads and drills), but if we compare it with the Current Netlist, we may get many false alarms for extra and missing net points. Therefore, it is recommended to compare the CAD Netlist with the Current-based CAD Netlist. The Current-based CAD Netlist uses all the net points of a CAD netlist but finds their connectivity using real features on a layer. Because the Current-based CAD is based on CAD netpoints, we avoid false extra/missing violations.

NOTE:

*See **Netlist Analyzer tutorial 1** for a more detailed explanation about the Current-based CAD Netlist.*

STEP 3: COMPARE CAD NETLIST WITH CURRENT-BASED CAD NETLIST

Execute the comparison by clicking on the **Compare** button.

If opens or shorts are reported, this means that the graphics and the CAD Netlist do not match. The reason for the mismatch might be that either the CAD Netlist file or the Gerber graphical data are corrupted.

Data corruption is a serious possibility and should be resolved before continuing with the job.

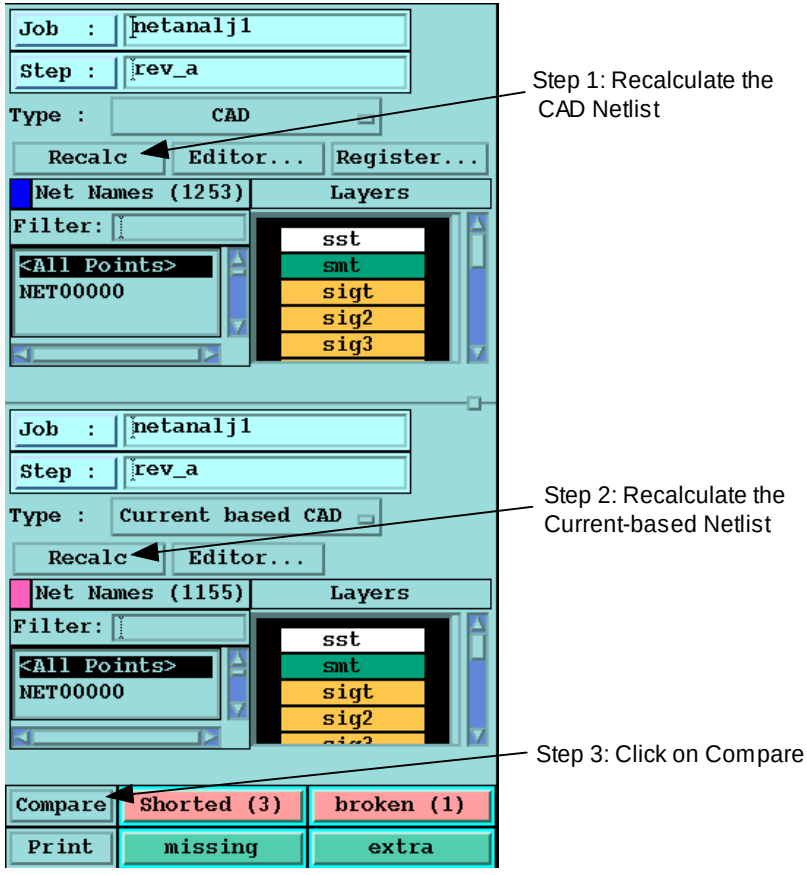
NOTE:

Sometimes the customer may allow some violations, i.e., the customer agrees to accept some known CAD Netlist and graphic mismatches.

NOTE:

For a more detailed explanation about the four possible violations (Short, Broken, Missing and Extra), see ***Netlist Analyzer Tutorial 1: Terms and Concepts****.*

Steps 1,2,3



NOTE:

It is possible to just click the ***Compare*** *button and the netlists will be automatically calculated. (This is slightly faster.)*

Step 4: Understand the violations

If there are netlist violations, try to understand the problems. If you identify real violations you should contact your customer. We are going to learn in this tutorial how to understand shorts and break violations.

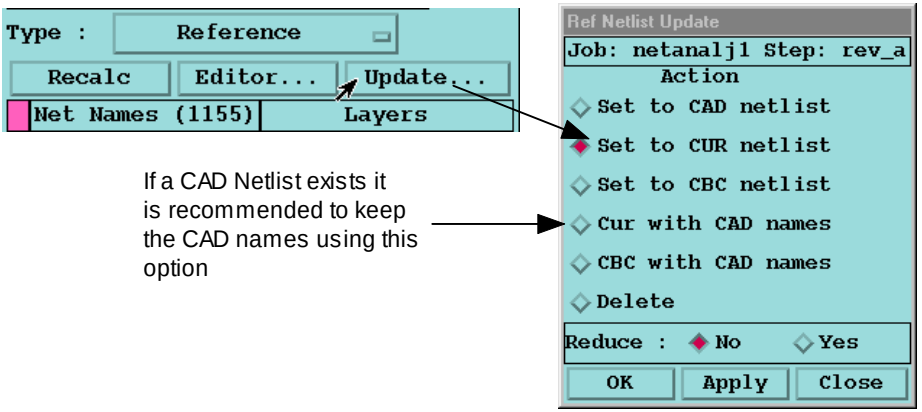
Steps 5 & 6: If Compare is successful, Calculate the Current Netlist and set the Reference Netlist to be the Current Netlist

The Reference netlist is used as a master reference during editing which is used for comparison with the Current Netlist, to ensure that changes have not violated netlist connectivity rules.

Step 5:
Calculating the Current Netlist

It is recommended to set the Current Netlist as the Reference netlist, rather than the Current-based CAD Netlist, because you want the Reference to contain all the netlist points for maximum protection against Netlist violations.

Step 6: Set the Reference Netlist to be the Current Netlist



STEP 7: WORKING WITH THE JOB

After you have set your Reference Netlist, you can now continue with your CAM work. When you finish your work, or any other time you want to verify the netlist, go to Step 8.

STEP 8: RECALCULATE CURRENT NETLIST

Recalculate a new Current Netlist, reflecting the actual connectivity of the real features on the board, according to the graphics.

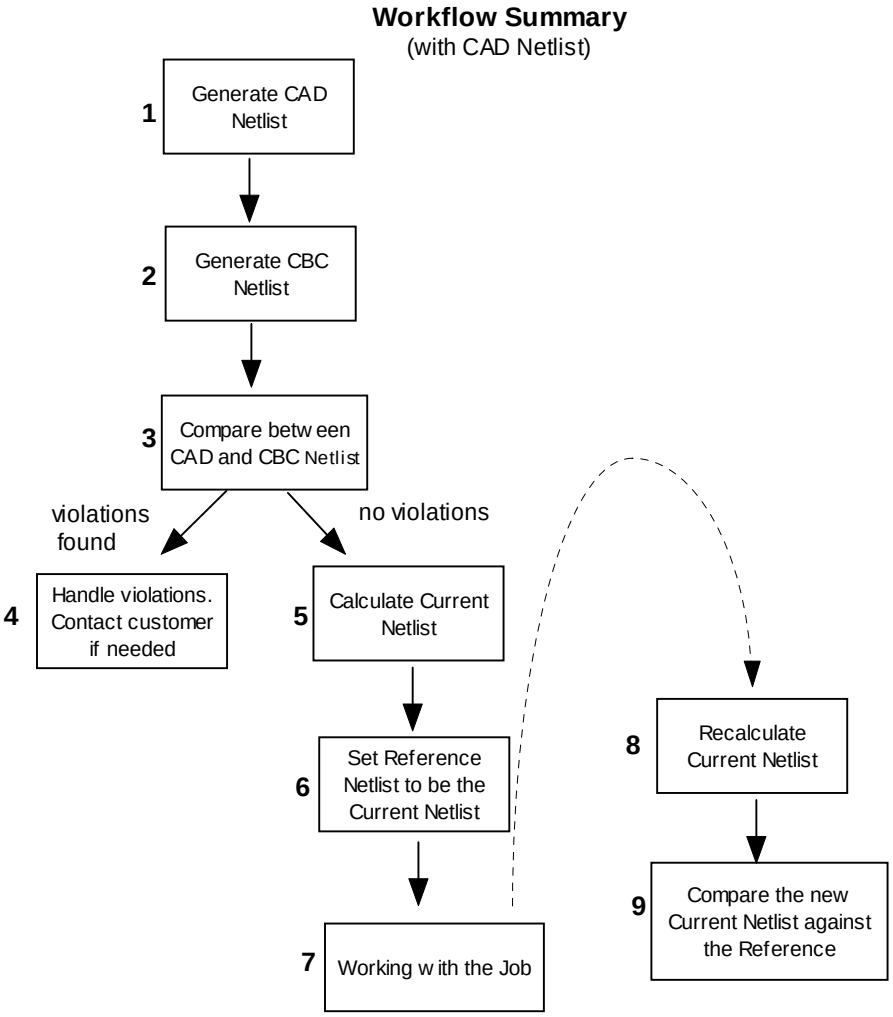
STEP 9: COMPARE THE CURRENT NETLIST WITH THE REFERENCE NETLIST

This is to check if you have violated netlist connectivity as a result of editing. If all the results are “green” then no netlist violation occurred. Otherwise, check why there are violations.

The netlist comparison may be done either from the Netlist Analyzer window or from the Online Netlist window in the Graphic Editor.

NOTE:

You may also do a Layer Compare in the Graphic Editor to compare the original layer to the edited layer.

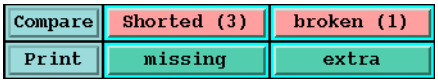


NOTE:

This workflow does not relate to the cleanup stage. Usually we do cleanup after step 3 and then repeat steps 2 & 3 again before calculating the Current Netlist. For detailed information about workflow with and without the CAD netlist, see doc. 0506 The Netlist Analyzer p.33-40 (the common procedure).

Locating Netlist Violations - Getting Started

In the second tutorial (p.24) we compared the CAD Netlist with the Current-based CAD Netlist and we got:



Now we will try to find what causes the netlist violations. During our explanation we will give you various tips to help you detect netlist violations. These Tips are only recommendations, so please feel free to work using the method you find easiest.

TIP 1:

Always start from the easier problem because it also may help solve part of the more difficult violations.

TIP 2:

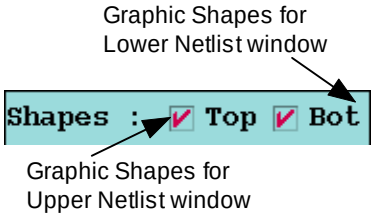
It is recommended to start with "shorts" because Genesis has automatic highlight to find many of them (in positive layers).

TIP 3:

*When you first view Shorted violations it is recommended to set the Zoom button to **Auto-Zoom**. In this zoom mode the system will automatically show you the short position, when possible.After you find the short, it is recommended to set the Zoom button to **No Zoom**. Otherwise, each time you click on a net the auto zoom will be activated, which is not a comfortable way to work.*

TIP 4:

*When you first view violations turn on the **Shapes** filter. In this mode you can see the nets better. Moreover, only when the shapes filter is turned on do asterisks (*) appear beside specific layers in the Layers list and automatic shorts highlight works. You can turn the Shapes filter off later when you want to get a simpler display of the net points only.*



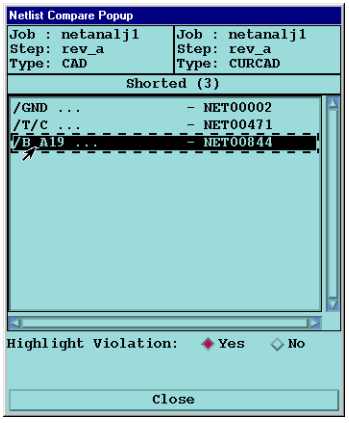
(Turning shapes off improves performance at the expense of functionality.)

We are going to start with an easy short in which the Netlist Analyzer automatically takes us to the location of the short.

Finding a Short Using Automatic Short Highlight

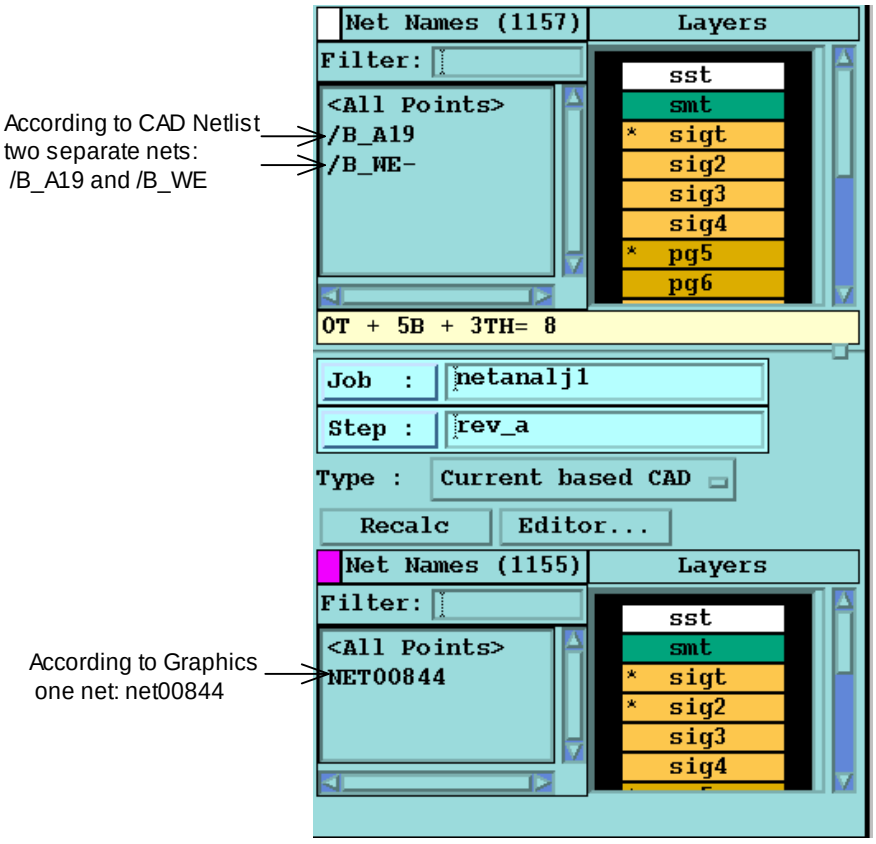
STEP 1:

Click on the **Shorted** button and you will get the following window.



STEP 2:

Click on the net **/B_A19** and close the Netlist Compare Popup.



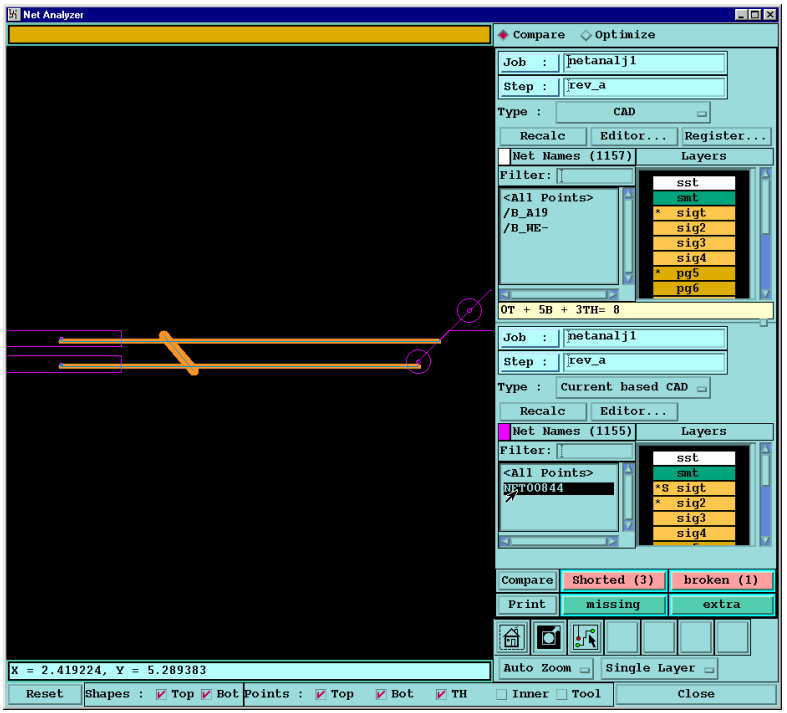
The short can be understood in this way: the nets /B_A19 and /B_WE were separate nets according to the CAD Netlist, but now they are shorted (according to the graphics) into one net called NET00844.

NOTE:

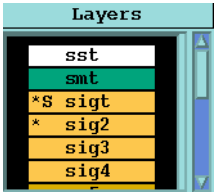
There is a refresh problem. After clicking on Shorted, you still see all the net points displayed on the screen even though <All Points> is not actually selected. To refresh the display, select and then unselect <All Points>.

STEP 3:

Click on the shorted net: **NET00844** (Make sure that the Zoom button is set to **Auto Zoom** mode, if you want to see exactly the place of the short.)



You can see that in the view area the violation is displayed highlighted and the layer containing the short will have an ‘S’ next to it in the Layer Name list. In our case we see that the short is in layer ‘sigt’.



TIP 5:

You can work with auto highlight only for positive (circuit) layers and planes. You cannot use it for negative P&G layers. In P&G layers you can use drill check analysis to help you find short violations. With difficult shorts

you can also change negative layer polarity to be positive (for example by inverting its polarity and merging it into a positive surface) and then try using the automatic short highlight.

Now, we are going to investigate this short and by doing so we will learn something important about the graphic shapes display.

Understanding the Short Between /B_A19 and /B_WE

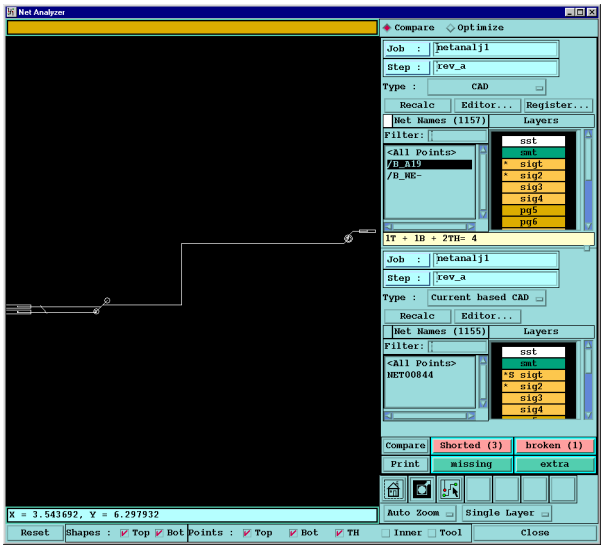
STEP 1:
Look at the display area.

Here it is obvious that the little vector causes a short. Yet before deleting it we can learn something useful from it.

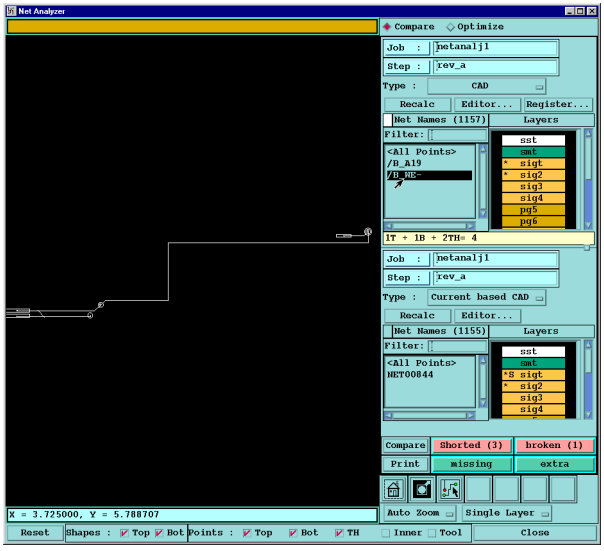
STEP 2:
(Make sure that the Shapes filter is turned on.)

Unselect **NET00844**.

Click on net **/B_A19**, you will get:



Now, click on **net /B_WE**, now you will get:

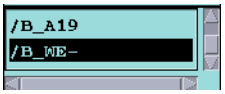


HERE IS SOMETHING TO THINK ABOUT

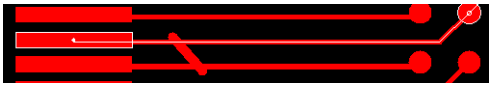
Nets /B_A19 and /B_WE are totally different nets according to the CAD Netlist. Therefore, we could expect to get the following display.

The **expected** display results are the following:

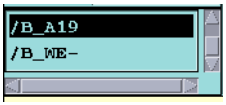
When clicking on net **B_WE,**



you expect that only net B_WE will be highlighted (this is not the result you will see).



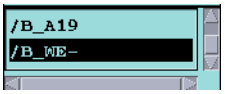
When clicking on net **/B_A19**,



you expect that only net B_A19 will be highlighted (this is not the result you will see).

But the **actual** display results are the following:

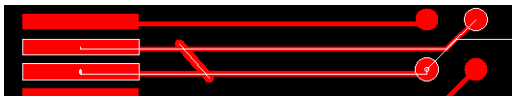
When clicking on net **/B_WE**,



you actually see both nets B_A19 and B_WE and the little short vector highlighted (this is the result you will actually see).

Also, when clicking on net **/B_A19**,

you actually see both nets B_WE and B_A19 and the little short vector highlighted (this is the result you will actually see).



HERE IS SOMETHING TO THINK ABOUT

Question: What is the reason that both CAD nets, B_WE and B_A19, are highlighted in the display even though we only click on one of them at a time?

Answer: The reason for this is that the **shapes are always taken from the current graphics**! We see the two nets together because they are connected according to the graphics. If you want to see exactly what were the original nets according to the CAD Netlist, you have to turn off the shapes filter, as explained below.

Turning off the Shapes Filter to see the Original CAD Netlist

To solve the problem described above, in order to see exactly the original CAD net points, we should turn off the shapes filter.

STEP 1:

Turn off shapes: top filter. (Turning off shapes for the upper window, i.e., CAD Netlist window.)

NOTE:

If you find the difference between the shapes (top, bot) confusing, you can always turn both of them on or off together.

STEP 2:

Click on net /B_A19. You will now see 2 netpoints which define what was the original net /B_A1 according to the CAD Netlist.

STEP 3:

Click on net /B_WE. You will see 2 net points which define what was the original net /B_WE according to the CAD Netlist.

The conclusion is summarized in the following tip.

TIP 6:

*When you want to know exactly what were the original CAD nets, turn off the shapes and look at the CAD net points only. Remember that **shapes are always taken from the graphics**. The CAD netlist does not include information about shapes. Therefore, when we want to see the exact graphic CAD Netlist it is recommended to look at the net points and not at the shapes.*

Fixing the Short B_A19 <-> B_WE

We are now going to fix this short.

STEP 1

Click on the **Editor** button to open the Graphic Editor with the same view area as we had in the Netlist Analyzer.

NOTE:

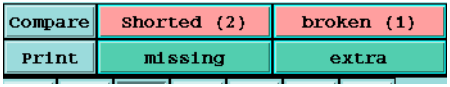
In order to see exactly the same view, you must select the same layers in the Graphic Editor that were displayed in the Netlist Analyzer.

STEP 2

Erase the little vector in layer sigt which causes the short.

STEP 3

Now return to the Netlist Analyzer and click the Compare button to make a new comparison between the CAD and Current-based CAD Netlists. You will get the following:



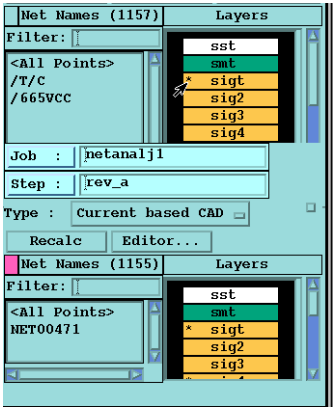
We get only 2 shorts here which means that we solved one short problem. The easy short is behind us, now we will check a little more difficult short.

Finding a Short Manually Without Automatic Highlight

We are now going to find the second short. By doing this, we will also learn how to set the net colors and how to understand the nets display.

STEP 1:

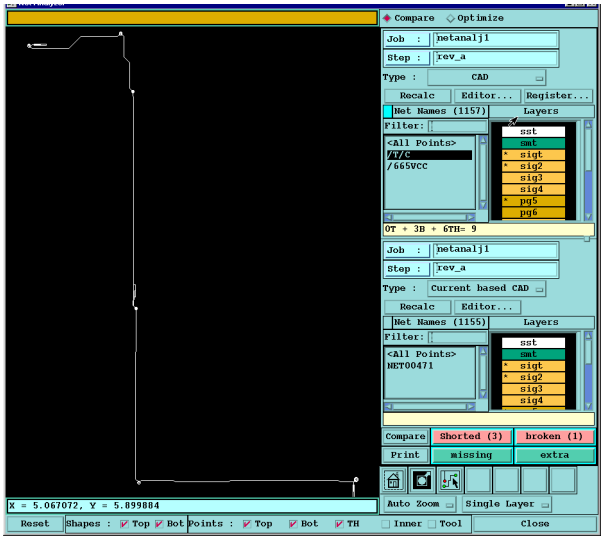
Now click on the second short **/T/C...NET00471** in the Netlist Compare Popup.



This is how we understand this short: two nets /T/C and /655VCC which were 2 separate nets according to the CAD Netlist, are now shorted into one net NET00471.

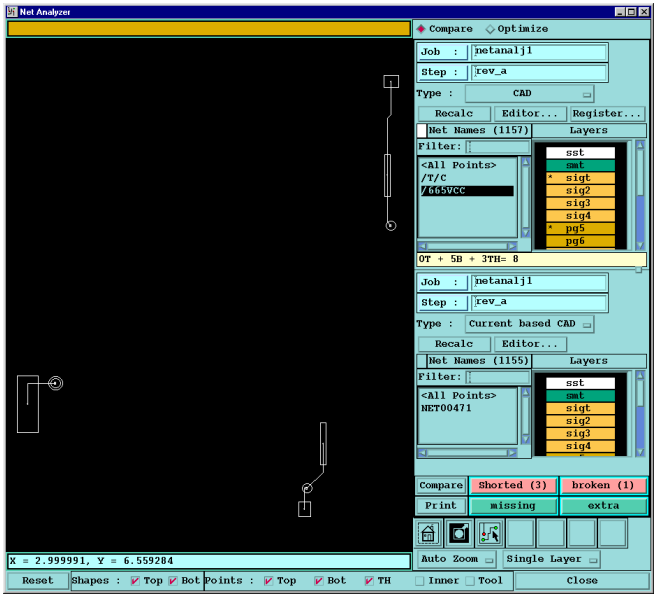
STEP 2:

We first want to see what were the original CAD nets. Click on the net **/T/C** in the CAD Netlist window, to see the first original CAD net.



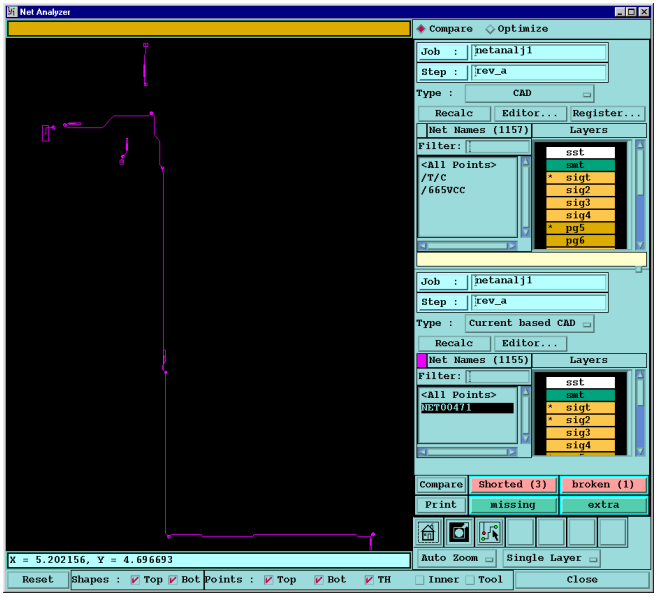
STEP 3:

Click on the net **/665VCC** in the CAD Netlist window, to see the second original CAD net.



STEP 4:

Click on the net **NET00471** in the Current-based CAD Netlist window to see the shorted net. You will see that the net displayed is a connection between both /T/C and /665VCC (i.e., the two nets /T/C and /665VCC which were separated according to the CAD are now connected according to the graphics).



TIP 7: ABOUT NETLIST COLORS AND DISPLAY

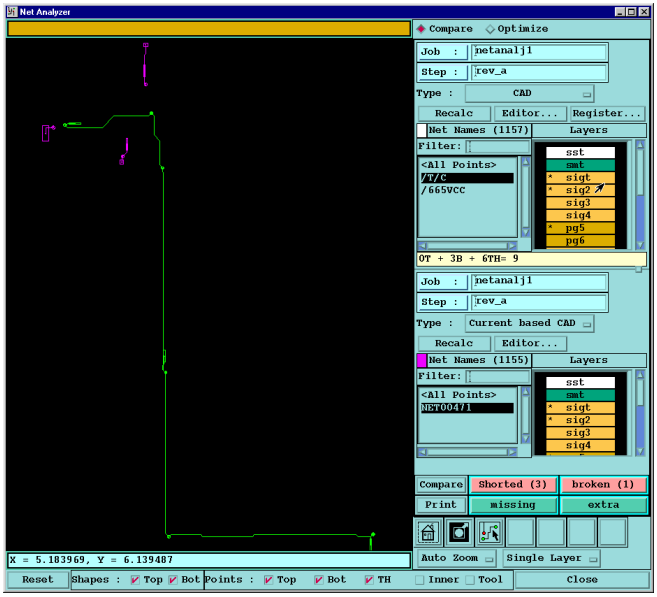
It is very important to have different colors with a good contrast between them. One color for displaying nets from the upper window and another color for displaying nets from the middle window. You can change the display colors using the Graphic Editor>Options>Colors. Change the selection color "SL" to change the color of the upper window. Change the highlight color "HL" to change the color of the middle window.

The next section shows you how to set color contrast.

Setting the Color Contrast

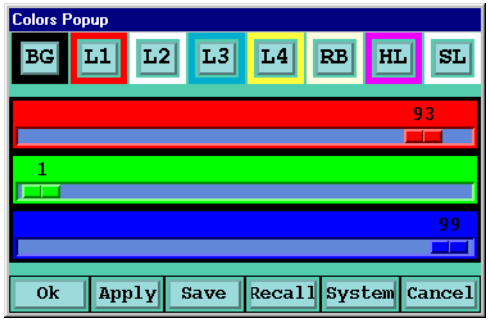
STEP 1:

Click on the net **/T/C** from the upper window and the net **NET00471** from the middle window.



STEP 2:

Select **Options>Colors** in the Graphic Editor to change the display colors.



Change Highlight (HL) and Selection (SL) colors to change the color of the nets in the upper and middle window, until you get a good color contrast between different nets.

Understanding the Graphic Display

One of the keys to understand netlist violations is to understand the graphic display of the Netlist Analyzer properly.

STEP 1:

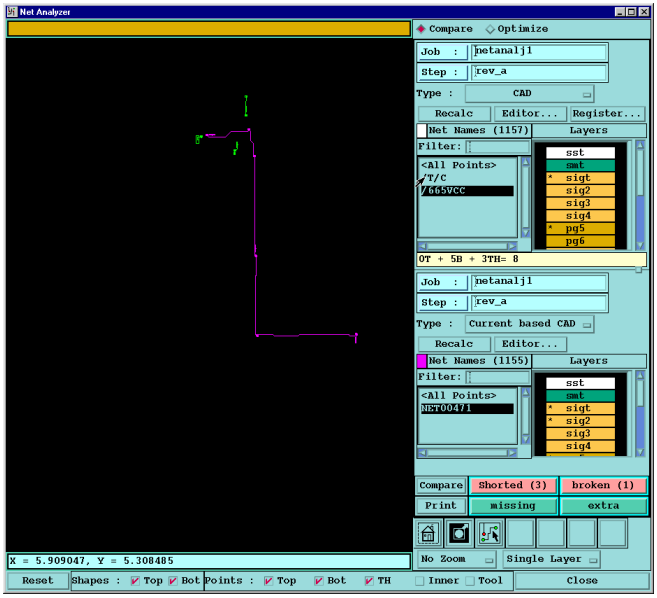
Set the Zoom button to **No Zoom** (to avoid automatic zoom changes which might not be comfortable for us in this case).

STEP 2:

Click on one net: **NET00471** (you get the shorted net in one color).

STEP 3:

Click once on net **T/C/** and then on net **/665VCC**. Do this several times (toggle between them). You can see clearly according to the display colors that /T/C and /665/VCC are part of the shorted net, NET00471.
(We can see by the color difference that nets /T/C and /665VCC were different nets according to the CAD Netlist, but now they have become one net, NET00471.)



Checking the Short between /T/C and /665VCC

Now that we understand that nets /T/C and /665VCC are shorted into net NET00471, we will now try to locate the violation.

TIP 8:

Always try to understand the net i.e., understand how the elements along the net are connected.

HERE IS SOMETHING TO THINK ABOUT

QUESTION:

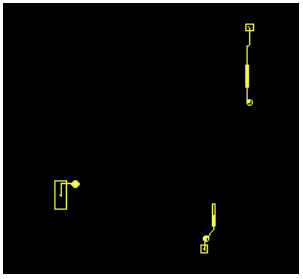
Look at the net /T/C/, use the displayed net shapes and the layers with asterisks in the netlist box and think about how the elements in the net are connected.

ANSWER:

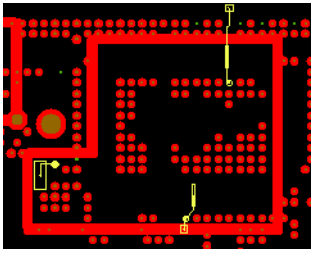
smd in sigb -> plated drill -> trace in sigt -> plated drill -> trace in sig2 ->plated drill -> trace in sig8 -> plated drill -> trace in sig2 -> plated drill -> trace in sig9 -> smd in sigb.

HERE IS SOMETHING TO THINK ABOUT

Now, look at net /665VCC and think about how the 3 pads in this net are electrically connected and why there are no traces between them (why they appear as 3 separate nets).



If you check each layer which has an asterisk you will see finally that the 3 pads in this net are connected through P&G layer ‘pg5’.



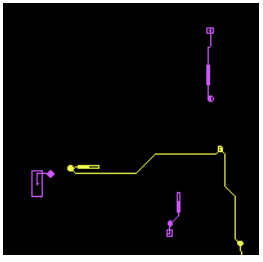
Actually we could guess this without checking all layers.

Since we see no traces between the 3 elements of the net (when the shapes filter is on), we know that they are not connected in a signal layer, otherwise we would see traces connecting them. This means that they are connected through a plane in a negative P&G layer, in this case ‘pg5’ (which is the only P&G layer which has an asterisk beside it for this net).

TIP 9:

When looking for a short, always try to think how the 2 different nets might be connected together.

Let us investigate how the 2 nets /T/C and /665VCC are shorted together.



We know for sure that they are connected according to our graphics because they turned out to be one single net according to the Current-based CAD Netlist.

In the following section we will discover how they are connected.

Finding out how Nets /T/C and /665VCC are Shorted

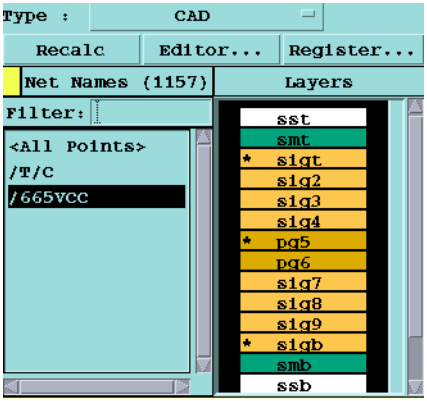
We will first do it the long way and afterwards we will give tips how to do it more quickly.

STEP 1:

In the upper window click on net **/665VCC**. In the middle window click on net **NET00471**. (Make sure that you can see the color difference between the 2 nets).

STEP 2:

Look at the Layers list for net /665VCC.



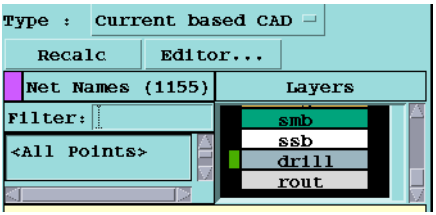
We are now going to click on each layer marked with an asterisk, one at a time and find out through which layer the 2 nets (/T/C/ and/665VCC) are connected. You only have to check the layers sigt, sigb and pg5 because these are the only layers through which net /665VCC might get shorted to another layer.

TIP 10:

When viewing layers it is very comfortable to work in single layer mode, to always display the drill layer from one netlist window and the second layer in the other netlist window.

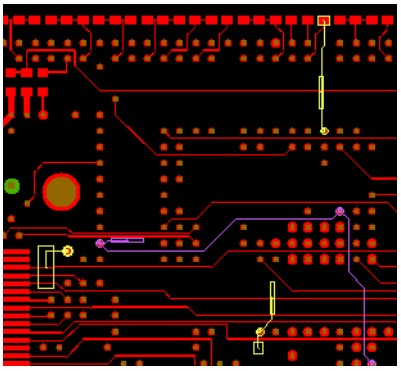
STEP 3:

Display the drill layer from the lower (middle) netlist window. It is very comfortable to always see the drill because this may help us understand how the nets are connected.



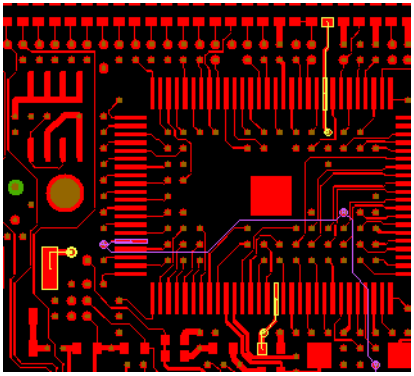
STEP 4:

Click on **sigt** in the upper netlist window.



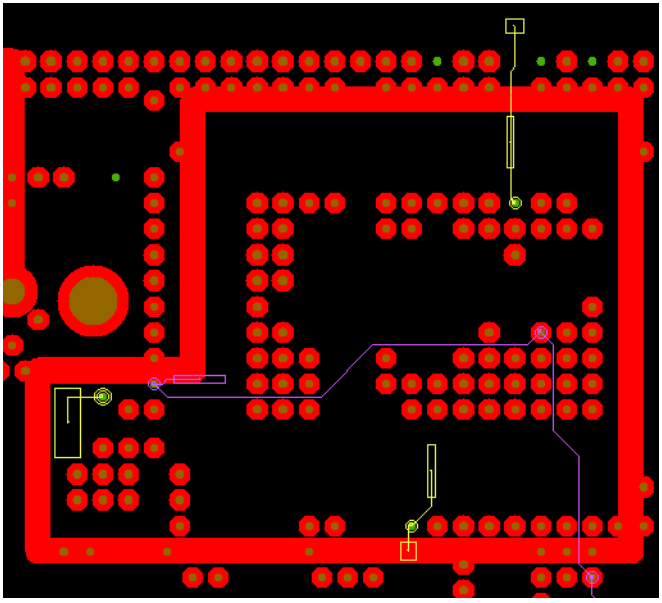
We can see that there is no connection between the 2 nets through this layer.

STEP 5:
Click on **sigb** in the upper netlist window.



We can see that there is no connection between the 2 nets through this layer.

STEP 6:
Click on **pg5** in the upper netlist window.



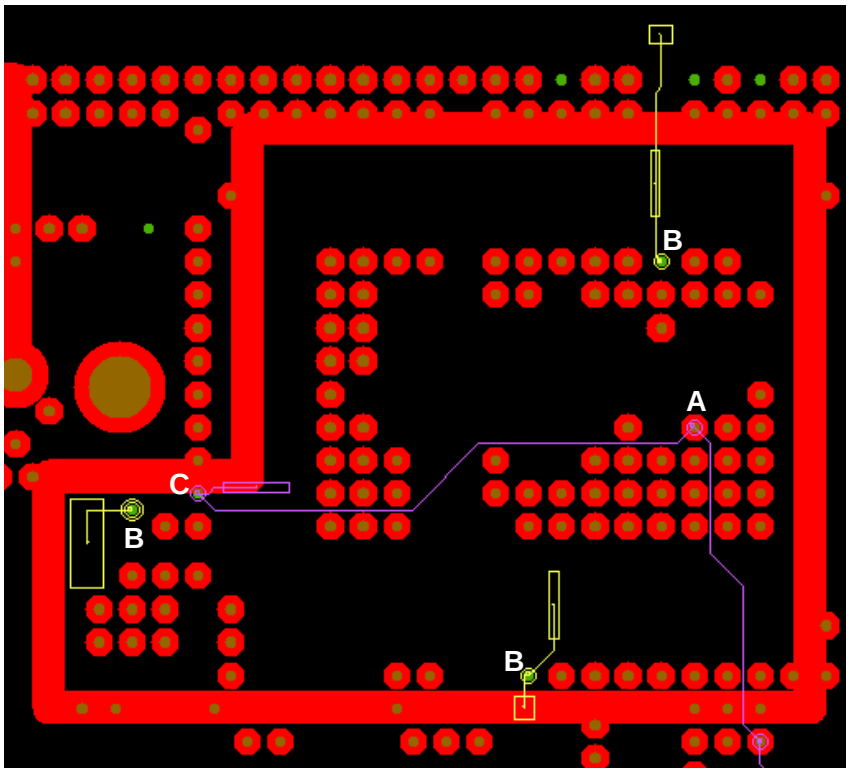
HERE IS SOMETHING TO THINK ABOUT

Question:

Are the 2 nets /665VCC and /T/C connected through this layer?

Answer:

We are going to check each drill and see if it causes a short between /655VCC and /T/C.



A: This plated via does not touch the plane and therefore does not cause a short problem. This is okay.

B: These 3 pads are connected together because they are connected to plated vias through a copper plane. This is okay because they belong to the same net.

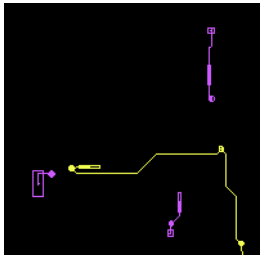
C: This plated drill partly touches the copper plane and therefore causes a short between net /665VCC and net /T/C. This is not okay because different nets get shorted!

After finding the short the systematic way, here are 2 alternative simpler ways:

A Simpler Way: Alternative 1

TIP 11:

When we see the shapes of the two nets and there are no traces between them (the nets do not appear connected), we can conclude that the nets are connected through a plane in a negative layer (e.g., negative P&G/mixed layer).



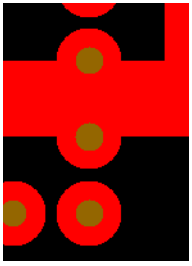
Therefore in this case, we can immediately guess that the short is through a plane in the P&G layer and in this case pg5. Because the short is through a negative plane, we do not see the shapes of the traces between the nets.

A Simpler Way: Alternative 2

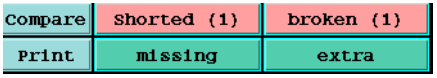
Read Tip 5 again. Change layer pg5 to be positive and then click on the shorted net. The system tells you automatically that the short is in pg5 and highlights the short. The exact short location may not be so clear, because the whole plane is highlighted. Yet, we can automatically know in which layer and in what area the short occurs.

Fixing the Short Between /T/C and /655VCC

To fix the short, add a clearance for plated drill C. (In a real job, you should first consult with your customer.)



Now make a comparison again between the CAD and CBC netlist. You will get the following:



This means that we have solved another short. Now we are going to find a short between the P&G layers.

Locating Shorts between P&G Layers

TIP 12:

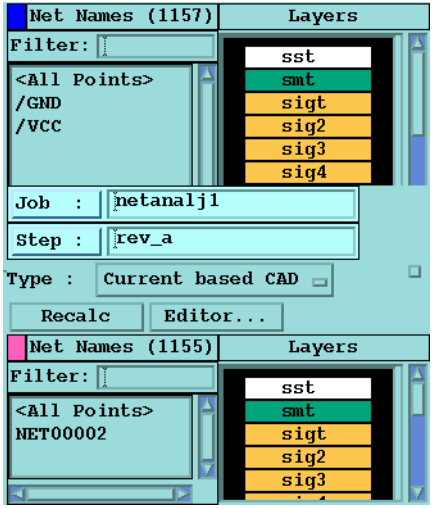
If one of the P&G nets is a small net, it is recommended to try to understand it and how it may be connected to the other P&G nets. However, if both of the P&G nets are big we need to use P&G shorts analysis to help us. This is described in the following steps.

STEP 1:

Click on line **/GND...NET00002** in the Netlist Compare Popup.

STEP 2:

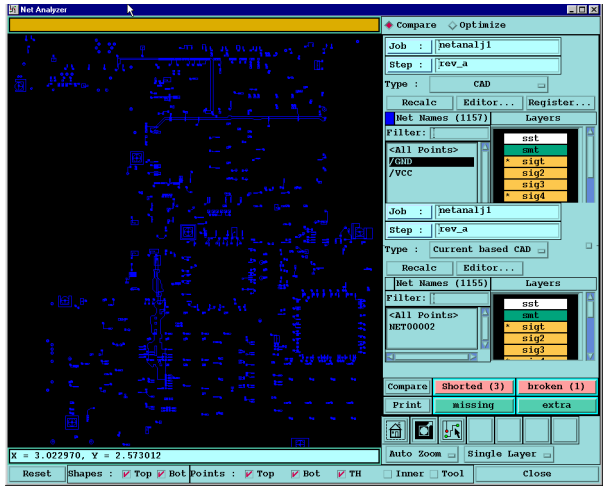
Look at the net names in the upper window and the middle window.



The short can be understood this way: According to the CAD Netlist (upper window) we had 2 different nets called **/GND** and **/VCC**. But now according to the Current-based CAD Netlist, we have one net called **NET00002**. This means that the 2 different nets **/GND** and **/VCC** are shorted into one net, **NET00002**.

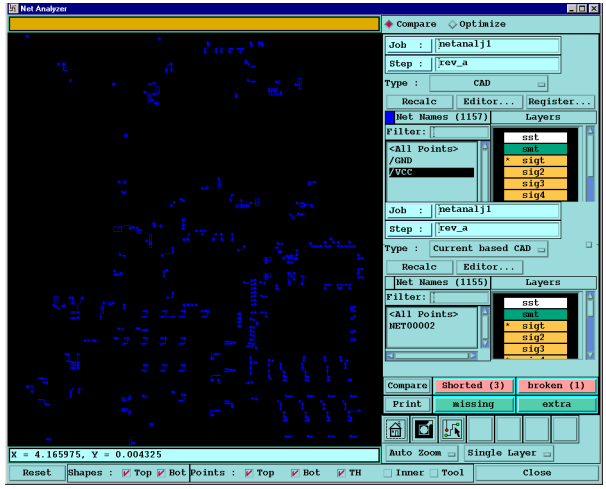
STEP 3:

Select the **/GND** net to see how it looks according to the CAD Netlist.



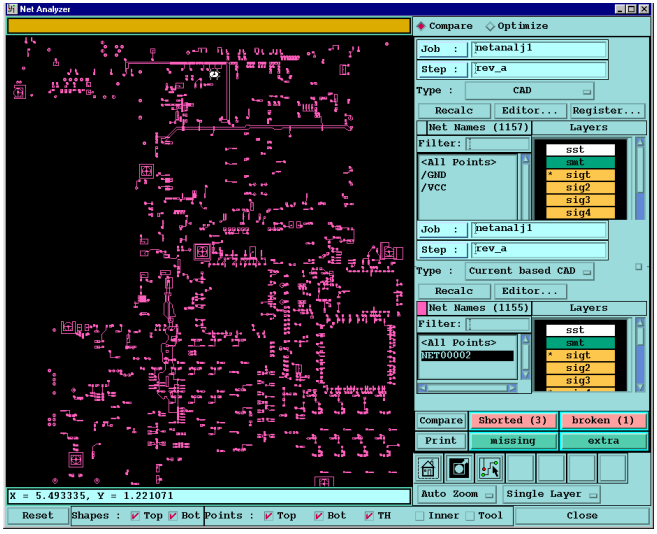
STEP 4:

Select the **/VCC** net to see how it looks according to the CAD Netlist.



STEP 5:

Unselect the **/VCC** net and select the net **NET00002**. This is the net according to the Current-based CAD Netlist (i.e., according to the actual graphics based on CAD net points. This net includes both the /GND and /VCC nets combined together, i.e. according to the graphics all the points shown in the display are connected).



TIP 13:

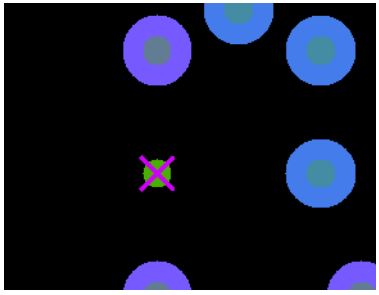
When we have to check a short between the P&G nets /GND and /VCC in which it might be difficult to manually check how they are connected together, we can use Drill Checks Analysis (P&G shorts).

STEP 6:

In the Graphic Editor open the Analysis menu and choose **Drill Checks**. Select only **Power/Ground Shorts** in the Drill Checks Action Screen.

Execute the analysis.

Look at the results and you will get the following location.



This means that at this location the drill touches two the P&G layers pg5 and pg6 and cause a short between GND and VCC.

NOTE:

Not every short found using P&G shorts check indicates a real short! Sometimes the customer does want some connection between the P&G layers. This analysis does not check a short according to the netlist, but only graphical connections between P&G layers according to the graphics and the drill layer.

STEP 7:

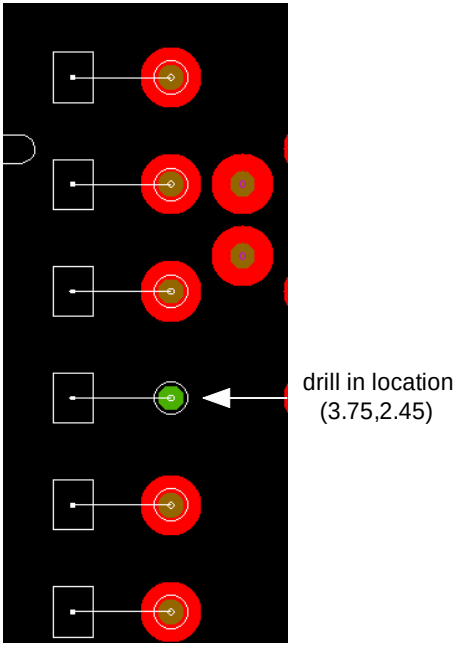
To solve this short, we need to add a clearance in pg5 or pg6 for this drill. But, how can we know in which layer to put the clearance? To know this we need to go back to the Netlist Analyzer, and check whether this drill should be connected to layers pg5 or pg6.

Find the drill's location coordinates, in our case (3.75, 2.45).

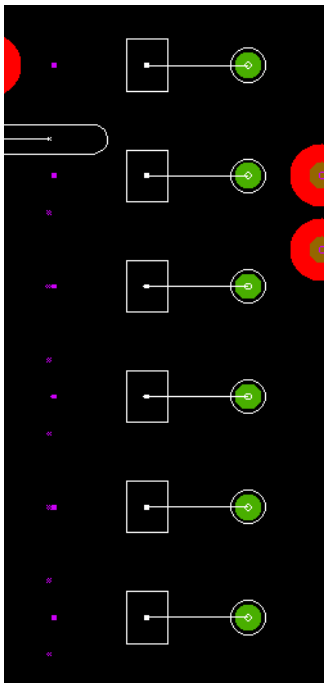
Open the Netlist Analyzer, display the drill layer and manually find the drill at this location.

STEP 8:

Display the layer pg6 and the drill layer. Click on net **/VCC**. You can see that our drill is part of the /VCC net and every other drill for the /VCC net has a clearance in this layer, i.e., is not touching this layer.



Now display layer pg5 and you can see that all the drills for the net /VCC including our drill should be connected to this layer.



Therefore, we see that our drill should be connected to pg5 but not connected to pg6.

NOTE:

*Another way to decide to which net the drill belongs is to click on the **Select by Net** button and then click on the drill at location 3.75,2.45.*

Fixing One Short Between /GND and /VCC

STEP 1:

Click the **Editor** button in the Netlist Analyzer to open the Graphic Editor at the location of our drill.

Add a clearance for our drill in layer pg6.

NOTE:

In real life situations it is more common to see a problem of a thermal instead of a clearance which causes a Power & Ground short. Sometimes it may be caused due to a mistake in the wheel file.

Unlike the above example in which we manually add a clearance, in real life you should consult with your customer before making any changes.

STEP 2:

Click the **Compare** button in the Netlist Analyzer and you will get the following:

This means we have now solved all the shorts.

NOTE:

In positive Power & Ground layers which have a lot of elements it is recommended to do cleanup before carrying out automatic short detection.

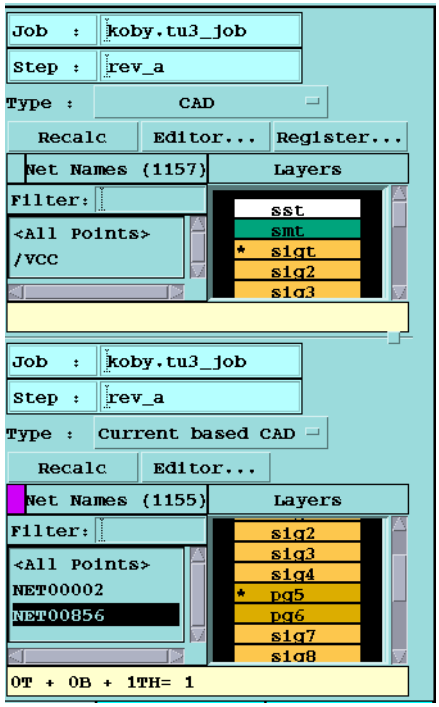
Now that we have finished discussing Shorts, we will now discuss Break violations.

Understanding a Break Violation

NOTE:

Unlike shorts, breaks are impossible to find because there are many ways to connect them. This is the reason why we can automatically find short violations but we can not automatically find break violations.

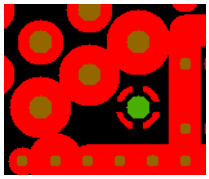
In the Netlist Compare Popup, click on the broken **/VCC - NET009**. You will get the following:



This break can be understood as follows: the net /VCC according to the original CAD netlist is now separated according to the graphics into 2 nets, NET00002and NET00856. We want to understand why these 2 nets got separated.

This break is easy, so we will only give a hint how to solve it.

Hint: Look at the nets NET00009 and NET00858. Start with the smaller one and look in layer pg5. Pay attention to the size of the clearances.

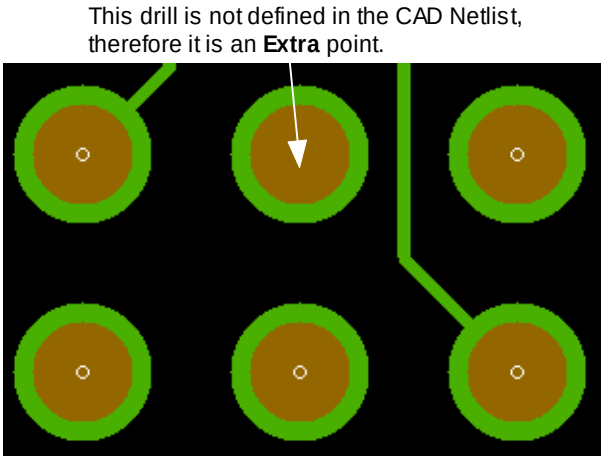


After we fix this break, we get a successful compare (without violations).

Understanding Extra Reports

STEP 1:
Now carry out a Compare between the CAD and Current Netlist. You will get 98 Extra reports.

STEP 2:
Watch the extra violations together with the available external layer. You can see that the reported locations are pads which where not reported as net points by the CAD Netlist. However, they are considered as net points by the Current Netlist and therefore you get extra net points here.



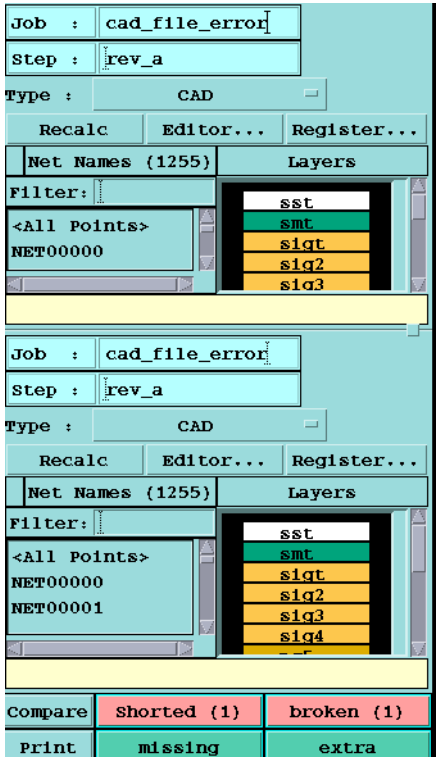
Tips for finding Problems with the CAD Netlist

Sometimes the CAD Netlist is not valid. For example, some net points may be defined twice in different nets. Sometimes a net point is defined in a wrong layer, e.g., a net point on top instead of a net point on bottom. Sometimes a net point for drill is defined when actually there is no drill. Another case may be a net point which is defined for a pad in an external layer, while actual there is no pad there.

Here are some tips to quickly identify CAD netlist problems. Some more examples will be given in tutorial 4.

TIP 14:

*If you get netlist violations when comparing CAD with Current-based CAD and you want to check whether the CAD Netlist file is corrupted or not, here is a way to check the CAD Netlist file: try to compare the **CAD Netlist** with the **CAD Netlist**.*



*This may not sound logical to compare CAD to CAD, but actually this test can check for errors in the CAD Netlist file. Your results should be green (no violations). If you get violations (red), click on the **Register** button and then on the **Reduce to Center** button, and compare again between CAD and CAD Netlist. If you still get red violations this means that the CAD Netlist file is not valid.*

TIP 15:

*Use the Filters, **top**, **bot**, **th**, when viewing the Cad Netlist. If you see mismatching, i.e. a net point defined as top, but actually the pad is in the bottom layer, or point defined in the CAD Netlist as drill, but actually there is no drill in the graphics, then there is a problem with the CAD netlist file.*

Summary

In this tutorial you learned about

- The typical Netlist Analyzer workflow
- Finding a short using automatic short highlight
- Understanding a short
- Turning off the shapes filter to see the original CAD Netlist (Remember: shapes are always according to the graphics. Therefore, turn them off to see the exact CAD Netlist.)
- Fixing a short
- Finding a short manually without using automatic highlight
- Setting the color contrast between nets
- Understanding the Netlist Analyzer graphic display
- Checking a short manually without automatic highlight
- Locating shorts between P&G layers
- Understanding a break violation
- Understanding Extra reports
- Tips for finding problems with the CAD Netlist

In the next tutorial we will give some examples, to let you practice on actual netlist problems.

Tips Summary

For your convenience, all of the tips found in this tutorial have been collected here.

TIP 1:

Always start from the easier problem because it also may help solve part of the more difficult violations.

TIP 2:

It is recommended to start with “shorts” because Genesis has automatic highlight to find many of them (in positive layers).

TIP 3:

When you first view Shorted violations it is recommended to set the Zoom button to **Auto-Zoom**. In this zoom mode the system will automatically show you the short position, when possible.After you find the short, it is recommended to set the Zoom button to **No Zoom**. Otherwise, each time you click on a net the auto zoom will be activated, which is not a comfortable way to work.

TIP 4:

When you first view violations turn on the **Shapes** filter. In this mode you can see the nets better. Moreover, only when the shapes filter is turned on do asterisks (*) appear beside specific layers in the Layers list and automatic shorts highlight works. You can turn the Shapes filter off later when you want to get a simpler display of net points only.

TIP 5:

You can work with auto highlight only for positive (circuit) layers and planes. You cannot use it for negative P&G layers. In P&G layers you can use drill check analysis to help you find short violations. With difficult shorts you can also change negative layer polarity to be positive (for example by inverting its polarity and merging it into a positive surface) and then try using the automatic short highlight.

TIP 6:

When you want to know exactly what were the original CAD nets, turn off the shapes and look at the CAD net points only. Remember that **shapes are always taken from the graphics**. The CAD netlist does not include information about shapes. Therefore, when we want to see the exact graphic CAD Netlist it is recommended to look at the net points and not at the shapes.

TIP 7: ABOUT NETLIST COLORS AND DISPLAY

It is very important to have different colors with a good contrast between them. One color for displaying nets from the upper window and another color for displaying nets from the middle window. You can change the display colors using the Graphic Editor>Options>Colors. Change the selection color “SL” to change the color of the upper window. Change the highlight color “HL” to change the color of the middle window.

TIP 8:

Always try to understand the net i.e., understand how the elements along the net are connected.

TIP 9:

When looking for a short, always try to think how the 2 different nets might be connected together.

TIP 10:

When viewing layers it is very comfortable to work in single layer mode, to always display the drill layer from one netlist window and the second layer in the other netlist window.

TIP 11:

When we see the shapes of the two nets and there are no traces between them (the nets do not appear connected), we can conclude that the nets are connected through a plane in a negative layer (e.g., negative P&G/mixed layer).

TIP 12:

If one of the P&G nets is a small net, it is recommended to try to understand it and how it may be connected to the other P&G nets. However, if both of the P&G nets are big we need to use P&G shorts analysis to help us.

TIP 13:

When we have to check a short between the P&G nets /GND and /VCC in which it might be difficult to manually check how they are connected together, we can use Drill Checks Analysis (P&G shorts).

TIP 14:

If you get netlist violations when comparing CAD with Current-based CAD and you want to check whether the CAD Netlist file is corrupted or not, **try to compare the CAD Netlist with the CAD Netlist**.

This may not sound logical to compare **CAD** to **CAD**, but actually this test can check for errors in the CAD Netlist file. Your results should be green (no violations). If you get violations (red), click on the **Register** button and then on the **Reduce to Center** button, and compare again between CAD and CAD Netlist. If you still get red violations this means that the CAD Netlist file is not valid.

TIP 15:

Use the Filters, **top**, **bot**, **th**, when viewing the Cad Netlist. If you see mismatching, i.e. a net point defined as top, but actually the pad is in the bottom layer, or point defined in the CAD Netlist as drill, but actually there is no drill in the graphics, then there is a problem with the CAD netlist file.

TIP 16:

If you get many netlist violations this could be due to a Registration problem or the order of layers was inverted in the CAD Netlist file. (Some of the exercises in the next tutorial will deal with this.)

Appendix

This section describes how to download the **demo_design** job used in this tutorial from Frontline's FTP site to your local system and how to install it in your local jobs directory. If you already have this job you can ignore this information.

Downloading demo_design.tgz by FTP

Here are the steps how to download the job by FTP.

Using a Browser

Download demo_design using Netscape or Microsoft Internet Explorer. In the location box, type: `ftp://ftp-us.frontline-pcb.com/pub/dnload/genesis/general/demo_design.tgz`

Using an FTP Application

1. Go to the directory on your local disk where you wish to download the file from the FTP server and at the system prompt, type: `cd temp` (for example).
2. Type the command to load the FTP and access the Frontline FTP server: `ftp ftp-us.frontline-pcb.com` or `ftp.frontline-pcb.com`
3. In response to *User*:, type: `ftp`
4. In response to: *Guest login* ok, *send your complete e-mail address as password*, type your email address in full after the "Password" prompt.
5. What you type will not be visible. The message is displayed: *Guest login ok access restrictions apply.* Type the directory of the FTP server from where you will perform the download: ftp> cd **/pub/dnload/genesis/general/**
6. The message is displayed: *CWD command successful*. This means you have accessed the directory you requested. If not, re-try. After successful access, type the following instruction to make the download a binary transfer: `ftp> bin`
7. The message is displayed: *200 Type set to I.* Now type the actual command to get the job. Note that you can not perform commands in this directory to display files. You must type the exact name of the file to download following: ftp: **get demo_design.tgz**

8 You will see displayed *200 PORT command successful, Opening BINARY mode data connection for analysis-tut.gz (xxxxxxxxbytes).*
After a short while, depending on network traffic, you will see displayed:
Transfer Complete.
xxxxxxxxx bytes received in xx.xx seconds (xx.xx Kbyte/sec)
This indicates a successful download of the job into the directory you specified when you started (in this example, \temp).

9 You can now exit the FTP application with: ftp> **quit**

You will now have **demo_design.tgz** in your temporary directory.

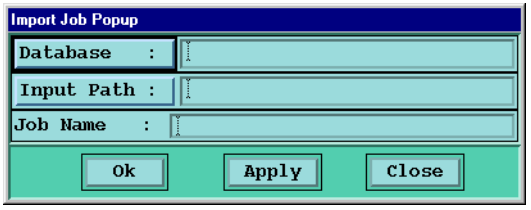
Installing the demo_design Job in your Database

Here is a description of how to take the demo_design.tgz from the local directory where it was downloaded to and install it as a job that can be read by Genesis.

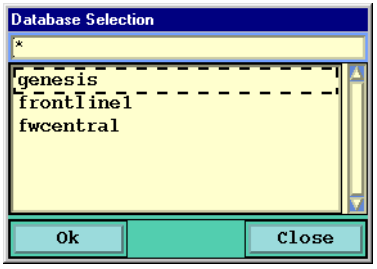
1 Open the Engineering Toolkit.

2 Open the file menu and select **Import Job**.

The Import Job Popup is displayed.

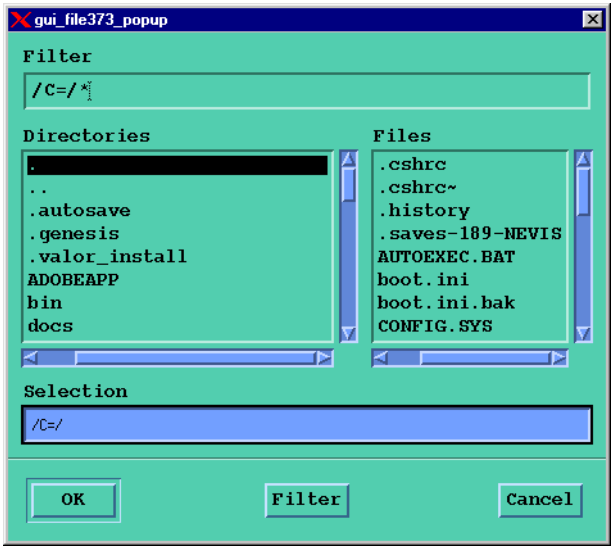


3 Click on the Database button to display the Database Selection popup which lists your database directories.



4 Select the database in which you want to place the **demo_design** job. Click the **Ok** button.

5 Now click on the **Input Path** button in the Import Job popup. The File input popup is displayed.



6 Select the source directory where you placed the **demo_design.tgz** file.

7 Select the demo_design.tgz file and click the **Ok** button.

8 The Import Job popup will be displayed again, each field listing what you selected.

9 Start the installation by clicking the **Ok** button.

After a few minutes, the **demo_design** job will be installed in your computer database and you can open it within the Genesis Application.