StarRC™ Parasitic Explorer User Guide

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SYNOPSYS®

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About This Manual

This Parasitic Explorer user guide describes how to use the StarRC Parasitic Explorer tool.

This manual describes how to use the StarRC Parasitic Explorer tool to understand and report parasitics that have been extracted by the StarRC tool and stored in a GPD Parasitic Database.

This preface includes the following sections:

- New in This Release
- Related Products, Publications, and Trademarks
- Conventions
- Customer Support

New in This Release

Information about new features, enhancements, and changes, known limitations, and resolved Synopsys Technical Action Requests (STARs) is available in the StarRC Release Notes on the SolvNetPlus site.

Related Products, Publications, and Trademarks

For additional information about the Parasitic Explorer tool, see the documentation on the Synopsys SolvNetPlus support site at the following address:

https://solvnetplus.synopsys.com

You might also want to see the documentation for the following related Synopsys products:

- StarRC™ User Guide and Command Reference
- PrimeTime® Suite
- Custom Compiler™
- Using Tcl With Synopsys Tools

Conventions

The following conventions are used in Synopsys documentation.

Convention	Description
`Courier`	Indicates syntax, such as `write_file`.
`Courier italic`	Indicates a user-defined value in syntax, such as `write_file` *`design_list`*
`Courier bold`	Indicates user input—text you type verbatim—in examples, such as `prompt>` **`write_file top`**
`Purple`	• Within an example, indicates information of special interest. • Within a command-syntax section, indicates a default, such as `include_enclosing =` **`true`** `| false`
[ ]	Denotes optional arguments in syntax, such as `write_file [-format` *`fmt`*`]`
...	Indicates that arguments can be repeated as many times as needed, such as *`pin1 pin2 ... pinN`*.
|	Indicates a choice among alternatives, such as `low | medium | high`
\	Indicates a continuation of a command line.
/	Indicates levels of directory structure.
Bold	Indicates a graphical user interface (GUI) element that has an action associated with it.
Edit > Copy	Indicates a path to a menu command, such as opening the **Edit** menu and choosing **Copy**.
Ctrl+C	Indicates a keyboard combination, such as holding down the Ctrl key and pressing C.

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Accessing SolvNetPlus

The SolvNetPlus site includes a knowledge base of technical articles and answers to frequently asked questions about Synopsys tools. The SolvNetPlus site also gives you access to a wide range of Synopsys online services including software downloads, documentation, and technical support.

To access the SolvNetPlus site, go to the following address:

https://solvnetplus.synopsys.com

If prompted, enter your user name and password. If you do not have a Synopsys user name and password, follow the instructions to sign up for an account.

If you need help using the SolvNetPlus site, click REGISTRATION HELP in the top-right menu bar.

Contacting Customer Support

To contact Customer Support, go to https://solvnetplus.synopsys.com.

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Overview

The Parasitic Explorer tool helps you query parasitic resistors and capacitors stored in a parasitic database (GPD) created by the StarRC extraction tool.

The overview of the Parasitic Explorer tool includes the following topics:

- Parasitic Explorer Features
- Parasitic Explorer Documentation
- Parasitic Explorer Session Management
- The Parasitic Explorer Shell Interface

Parasitic Explorer Features

The StarRC Parasitic Explorer tool provides methods for exploring the contents of a GPD, which is a compact and efficient binary database that contains design parasitics extracted by the StarRC tool. In the GPD, parasitic resistors and capacitors are considered to be design objects that can be handled in ways similar to other design objects.

The Parasitic Explorer tool is a Tcl (tool command language) environment with a prompt of starrc_shell. You can execute Tcl commands in the shell interactively. Alternatively, you can write scripts to automate tasks.

For both gate-level and transistor-level parasitic explorer flows, you can use the Tcl shell or the GUI to perform tasks such as the following:

- In the Tcl shell:
    - Create a collection of parasitic resistors, ground capacitors, or coupling capacitors from one or more nets
    - Query parasitic element attributes such as resistance, capacitance, subnode name, layer name, layer number, and physical location
    - Report properties of the data in the GPD such as completeness, the StarRC version used to perform the extraction, the presence or absence of specific types of data, and the number of nets, cells, and ports
    - Report the corner names and layer names defined in the GPD
- In the GUI:
    - Annotate parasitics on specific nets for easy visualization
    - Visualize opens and shorts for debugging

Usage requirements are as follows:

- The GPD must be created by StarRC version O-2018.06-SP4-1 or later.
- You must have the Parasitic Explorer license and either the StarRC Ultra or StarRC Ultra+ license. You cannot use combinations of other StarRC licenses.
- You must have the Custom Infrastructure license that is part of the Custom Compiler product family to use the `starrc_explorer` command (the standalone Custom Compiler interface).

Parasitic Explorer Documentation

If you need help, information is available from the following sources:

- Command information displayed with the help command
- Man pages displayed with the man command
- Help in the graphical user interface
- The *StarRC User Guide and Command Reference* user guide, available on SolvNetPlus
- The *Using Tcl With Synopsys Tools* user guide, available on SolvNetPlus

Command Help

The help command provides concise information about Parasitic Explorer commands. You can display a list of commands or view the syntax of a specific command.

The help * command shows a list of commands, organized by command group:

```
starrc_shell> help *
 ...
Default Command Group:
 add_to_collection, all_inputs, all_instances
 ...
```

You can use wildcards to restrict the scope of the list or to find the name of a command that you cannot remember exactly. For example, to find all commands that contain the string “capacitor,” enter

```
starrc_shell> help *capacitor*
 get_ground_capacitors           # Find parasitic ground capacitors
 get_coupling_capacitors         # Find parasitic coupling capacitors
 ...
```

For a concise description of a command, enter help with the command name:

```
starrc_shell> help get_ground_capacitors
 get_ground_capacitors   # Get ground capacitor collection objects
```

To see the full command syntax, including options and arguments, use the -verbose option:

```
starrc_shell> help get_ground_capacitors -verbose
 get_ground_capacitors   # Get ground capacitor collection objects
   [-filter expression]      (Filter collection with 'expression')
   [-quiet]                  (Suppress all messages)
   [-parasitic_corners corner_name]  (Parasitic corner selection)
   [-all_parasitic corners] (Select all parasitic corners)
   [-of_objects objects]    (Get ground capacitors of these nets)
   [-from_node from_node]   (From pin, port, or net internal node)
   [-to_node to_node]       (To pin, port, or net internal node)
```

An alternate method to display the same information is to enter the command name directly with the `-help` option:

```
starrc_shell> get_ground_capacitors -help
 get_ground_capacitors   # Get ground capacitor collection objects
   [-filter expression]     (Filter collection with 'expression')
   [-quiet]                 (Suppress all messages)
   [-parasitic_corners corner_name]  (Parasitic corner selection)
   [-all_parasitic corners] (Select all parasitic corners)
   [-of_objects objects]    (Get ground capacitors of these nets)
   [-from_node from_node]   (From pin, port, or net internal node)
   [-to_node to_node]       (To pin, port, or net internal node)
```

Man Pages

To find descriptive information about a command, variable, or system message, use the `man` command at the `starrc_shell>` prompt during a Parasitic Explorer session. Type `man` followed by the command name, variable name, or message code.

Man pages for commands follow a standard format that includes the syntax, a description of each option and argument, a general description of the command and its usage, examples, and a list of related commands and variables.

Man pages for variables show the name, value type (string, list, Boolean, integer, or floating-point number), the default, and a description of the variable and its effects.

Man pages for error, warning, and information messages include the name, a brief description, and some suggestions for followup actions. To view the man page for an error message, use the `man` command with the message code. Type uppercase letters for the error code.

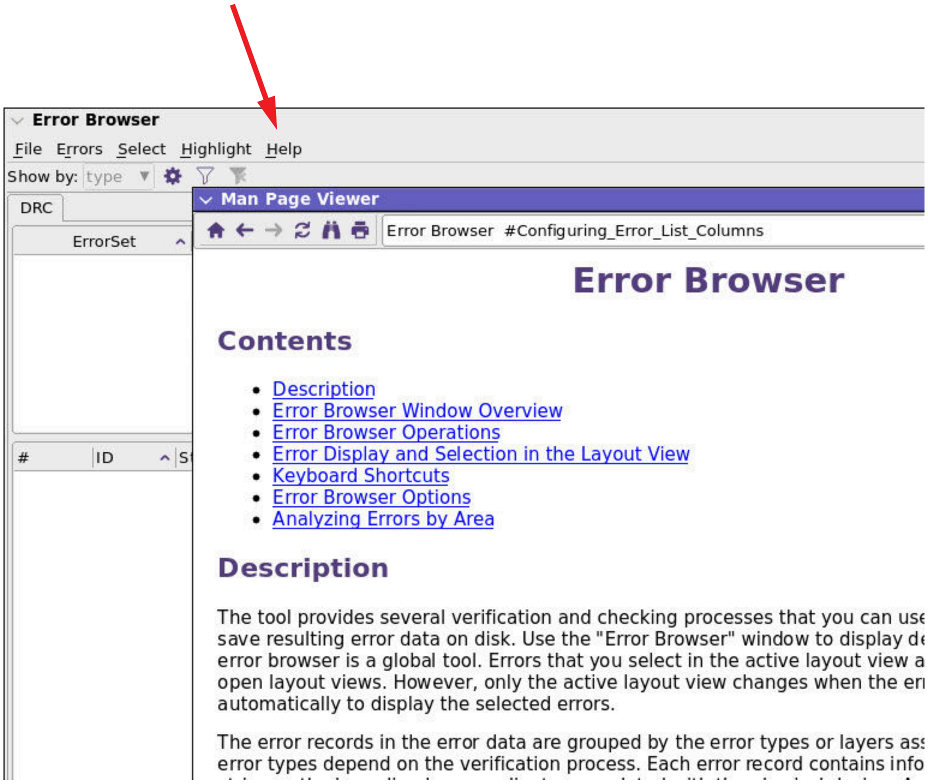
Note:

> Some man pages are shared with the PrimeTime static timing analysis tool. Some information in the man pages might not be valid for the Parasitic Explorer tool.

User Interface Help

When you are using the Parasitic Explorer GUI, you can find general information about the UI layout and features by clicking **Help**, as shown in Figure 1.

Figure 1 Example of User Interface Help


Error Browser
File Errors Select Highlight Help
Show by: type
DRC
ErrorSet
# ID St
Man Page Viewer
Error Browser #Configuring_Error_List_Columns

Error Browser

Contents

- Description
- Error Browser Window Overview
- Error Browser Operations
- Error Display and Selection in the Layout View
- Keyboard Shortcuts
- Error Browser Options
- Analyzing Errors by Area

Description

The tool provides several verification and checking processes that you can use save resulting error data on disk. Use the "Error Browser" window to display de error browser is a global tool. Errors that you select in the active layout view a open layout views. However, only the active layout view changes when the err automatically to display the selected errors.

The error records in the error data are grouped by the error types or layers ass error types depend on the verification process. Each error record contains info

Parasitic Explorer Session Management

The Parasitic Explorer tool runs under the Linux operating system. Before you can use it, the application must be installed and licensed at your site.

To start an interactive session, enter the `starrc_shell` command at the operating system prompt.

The Parasitic Explorer tool checks out a StarRC license and displays an initial message and the `starrc_shell` prompt. Here is an example, but the message you see might be different depending on the version.

```
                              StarRC
    Version R-2020.09 for linux64 - December 9, 2019
              Copyright (c) R-2020.09 by Synopsys, Inc.

This software and the associated documentation are proprietary to
to Synopsys, Inc. This software may only be used in accordance with
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Inc. All other use, reproduction, or distribution of this software is
strictly prohibited.

starrc_shell>
```

To end a Parasitic Explorer session, enter the `quit` or `exit` command at the prompt:

```
starrc_shell> exit
Maximum memory usage for this session: 0.72 MB
CPU usage for this session: 0 seconds
Diagnostics summary: 2 errors

Thank you for using starrc_shell!
%
```

The Command Log File

The Parasitic Explorer tool saves the session history in the command log file. This file contains all of the commands executed during the session and serves as a record of your work. You can repeat the session by running the file as a script, using the `source` command.

The log file is named starrc_shell_command.log and is located in the current working directory. A new log file overwrites an existing log file with the same name. Before you start a new session, rename any log files that you want to keep.

You can specify a name for the command log file by setting the `sh_command_log_file` variable in a setup file. You cannot change this variable during a session.

The Parasitic Explorer Shell Interface

The starrc_shell interface is based on the Tcl scripting language. You can use features of Tcl such as user-defined variables, procedures, conditional execution, lists, and expressions.

The command syntax is case-sensitive. Commands, command options, arguments, and variables generally consist of lowercase characters.

Object names in the design are also case-sensitive. For example, the names clk and CLK refer to two different design objects.

A detailed description of the features of Tcl is beyond the scope of this user guide. For more information, see *Using Tcl With Synopsys Tools*, which is available on SolvNetPlus, or a reference book on Tcl.

The prompts are programmable. By default, the primary prompt is starrc_shell> and the secondary prompt is a question mark (?). To change the prompt, set the tcl_prompt1 or tcl_prompt2 variable to the name of a procedure that displays the new prompt. The procedure cannot take an argument. For example, to make the primary prompt an asterisk (*>), do the following:

```
starrc_shell> proc prompt1 {} { echo -n "*> " }
starrc_shell> set tcl_prompt1 prompt1
prompt1
*>
```

Entering Commands Interactively

You can abbreviate command names and options to the shortest unambiguous string. For example, you can abbreviate the get_attribute command to get_attr .

Using command abbreviations is convenient for interactive sessions. However, avoid using abbreviations in scripts, because command changes in later releases might make the abbreviations ambiguous.

The sh_command_abbrev_mode variable determines whether command abbreviation is enabled. The default is Anywhere; you can also set the variable to Command-Line-Only . To disallow all command abbreviation, set the sh_command_abbrev_mode variable to None.

If you enter an ambiguous command, the tool attempts to help you find the correct command. For example, the all_in command as entered here is ambiguous:

```
starrc_shell> all_in
Error: ambiguous command 'all_in' matched 2 commands:
       (all_inputs, all_instances) (CMD-006)
```

The error message lists up to three possible matches. To list all of the commands that match the ambiguous abbreviation, use the help function with a wildcard pattern. For example,

```
starrc_shell> help all_in_*
 all_inputs        # Create a collection of all input ports in a design
 all_instances     # Create a collection of all instances of a design
```

You can split long commands across multiple lines by using the backslash (`\`) continuation character or by clicking the Enter key while a command is still incomplete. In this case, the tool displays the secondary prompt for each additional line of the command. The default secondary prompt is a question mark. For example,

```
starrc_shell> alias my_cap_report {get_ground_capacitors \
? -of_objects list_of_nets}
```

In this user guide, a command that cannot fit on one line is shown on multiple lines with the continuation character. However, the secondary prompt is omitted from the examples.

Using Command Scripts

A command script is a text file containing a sequence of commands. Create scripts to carry out complex or repetitive tasks. The log file generated at the end of an interactive session can also be used as a script.

The Parasitic Explorer tool recognizes script files in plain ASCII format, ASCII compressed in gzip format, and ASCII encoded into bytecode format by the TclPro Compiler. To execute a script in any of these forms, use the `source` command:

```
starrc_shell> source file_name
```

To execute a script upon startup, use the `-file` option (short form `-f`):

```
% starrc_shell -f file_name
```

You can create scripts that use variables, loops, and conditional execution. The flow control commands `if`, `while`, `for`, `foreach`, `break`, `continue`, and `switch` determine the execution order of other commands.

Any line of text in a script file that begins with the pound sign (`#`) is a comment. Any text from a semicolon and pound sign (`;#`) to the end of a line is also considered to be a comment.

You can redirect the output to a file. The following command runs the Tcl script named rc_analysis.tcl and redirects all output and error messages to the file result_file.out.

```
% starrc_shell -file rc_analysis.tcl > result_file.out
```

If your script contains a syntax error, the tool stops and waits for input unless the sh_continue_on_error variable is set to true.

End the script with the quit or exit command. Otherwise, the starrc_shell prompt does not appear, and you do not know when the script has finished executing. If your script does not end with the quit command, the tool waits for input. Type quit or exit to end the session.

Tcl Commands

Commands are statements that cause actions, such as defining values, executing analysis, or displaying reports. The result of the command is displayed. When there is no specific resulting output, commands return a 1 to indicate success and a 0 to indicate failure. For example:

```
starrc_shell> read_parasitics -keep_capacitive_coupling -format gpd gpd
1
```

Command examples in this user guide do not always show the return value.

For some commands, the result is a collection. For example, the result of the get_ports command is a collection of ports. The following command creates a collection of all ports whose names begin with the letters IN .

```
starrc_shell> get_ports IN*
{"IN1", "IN2", "IN3", "IN4"}
```

After the command executes, the collection handle is displayed. The collection handle is an automatically-generated name for the collection of objects created by the command. If you want to use the objects in additional operations, set the collection to a variable or nest it within another command.

Enclose each nested command in square brackets. For example, the report_attribute command lists the attributes attached to one or more specified input ports. The following example creates a collection of input ports with the get_ports command and passes the result to the report_attribute command:

```
starrc_shell> report_attribute [get_ports IN*] -application
```

Even if a command accepts a design object name (or list of names) directly, it is good practice to use the get_* commands to create the collection to ensure that the collection contains only items of the specified type.

If object names contain escape characters, use the -exact option with the get_* command to specify the names. For example:

```
report_ground_capacitors -of_objects [get_nets -exact {net\\[0\\]}
```

The output of some commands is a report. By default, the display scrolls through the entire report. To pause between screens of text (similar to the `more` command in the operating system), set the `sh_enable_page_mode` variable to `true`.

To view a long report in this mode, press the space bar to view each successive screen. To cancel a long report and return to the `starrc_shell` prompt, type the letter *q* .

You can interrupt a command in progress by typing the Ctrl+C key sequence. Computationally intensive commands might take some time to stop. Typing Ctrl+C multiple times terminates the shell and returns to the operating system prompt.

Parasitic Explorer Variables

Variables hold data. You can control some execution options by specifying the value of application variables. You can also define user variables for convenience in scripts or at the command line. To specify the value of a variable, use the `set` command:

```
starrc_shell> set variable_name value
```

You can use the `set_app_var` command instead of the `set` command when you set the value of an application variable. In this case, if the tool does not recognize the variable name, the tool issues a warning and defines a new user variable with the given name:

```
starrc_shell> set_app_var abc value
Error: Variable ‘abc’ is not an application variable. Value will still
be set in Tcl. (CMD-104)
Information: Defining new variable ‘abc’. (CMD-041)
```

When you set an application variable, the displayed result is the new setting for the variable:

```
starrc_shell> set sh_enable_page_mode true
true
```

If you attempt to set an application variable to an invalid value, the tool issues an error message. For example,

```
starrc_shell> set sh_enable_page_mode maybe
Error: can't set "sh_enable_page_mode": invalid value:
       use true or false
Use error_info for more info. (CMD-013)
```

To determine the current setting for a variable, use the `printvar` command. For example,

```
starrc_shell> printvar sh_enable_page_mode
sh_enable_page_mode  = "false"
```

You can use one or more wildcard characters (*) to view a group of variables. For example, to see a list of variables whose names include the string “corner,” enter

```
starrc_shell> printvar *corner*
parasitic_corner_name = ""
```

Error, Warning, and Information Messages

The Parasitic Explorer tool issues formal messages when a condition arises that requires user attention. Messages have three severity levels:

- Information: No action required if the condition is acceptable
- Warning: Serious condition, likely to be undesirable, but does not stop execution
- Error: Serious condition that prevents analysis from continuing

Some commands provide a `-quiet` option to suppress all warning and error messages. This is common with the `get_*` commands (such as the `get_cells` or `get_nets` commands) because complicated filtering operations might return many unimportant messages while the filter operates on various objects.

Design Object Attributes

An attribute is a string or value associated with an object in the design that carries some information about that object. For example, the `layer_name` attribute of a parasitic resistor indicates the layer of the resistor shapes. You can write Tcl scripts to get attribute information from the design database and generate custom reports about the design.

Attributes are read-only values that the tool assigns during execution. However, some attributes obtain their values from variables or command options that you specify.

Table 1 lists the commands for working with attributes.

Table 1 Attribute Commands

Attributes	Description
`list_attributes`	Lists the names of available attributes by object class.
`get_attribute`	Retrieves the value of one attribute associated with one object.
`report_attribute`	Displays the values of all attributes associated with one or more objects.

Listing Attribute Names

The `list_attributes` command displays an alphabetically sorted list of attributes. The list includes the names and properties of the available attributes, but not their values.

Note:

> Parasitic Explorer does not support user-defined attributes or imported attributes.

To limit the listing to a specific object class, use the `-class` option. You must include the `-application` option. An example of an attribute list is shown here.

```
starrc_shell> list_attributes -class ground_capacitor -application

****************************************
Report : List of Attribute Definitions
...
****************************************
Properties:
    A - Application-defined
    U - User-defined
    I - Importable from design/library (for user-defined)
    S - Settable
    B - Subscripted

Attribute Name        Object             Type     Properties  Constraints
-------------------------------------------------------------------------
capacitance           ground_capacitor   float    A
capacitance_max       ground_capacitor   float    A
capacitance_min       ground_capacitor   float    A
...
```

Reporting All Attribute Values for an Object

Use the `report_attribute` command to generate a report of attribute values associated with specified objects in the design. You must use the `-application` option. For application attributes that are of the type *collection,* the name of the first object in the collection is displayed. The following example uses the `get_resistors` command to identify parasitic resistors associated with net n833 in a design named Design_A, then passes that result to the `report_attribute` command:

```
starrc_shell> report_attribute [get_resistors -of_objects n833] \
              -application

****************************************
Report : Attribute
...
****************************************

Design     Object      Type          Attribute Name      Value
------------------------------------------------------------------
```

```
Design_A   resistor    boolean       is_short              false
Design_A   resistor    int           layer_id              2
Design_A   resistor    string        layer_name            metal1
Design_A   resistor    collection    net                   n833
...
```

Reporting Specific Attribute Values

To report the value of a single attribute for a specific object (or set of objects), use the `get_attribute` command. The following example lists the capacitance values of all of the ground capacitors associated with net n833:

```
starrc_shell> get_attribute [get_ground_capacitors -of_objects n833] \
              capacitance
0.000000 0.000167 0.000023 0.000116 0.000030 0.000082
...
```

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Using the Parasitic Explorer Tool

You can work with the Parasitic Explorer tool using a Tcl shell or a graphical user interface.

For information about using the Parasitic Explorer tool, see the following topics:

- Creating a GPD for Parasitic Explorer Tool Use
- Using The Interactive StarRC Shell
- Analyzing and Debugging in Gate-Level Flow
- Analysing and Debugging in Transistor-Level Flow
- Using Tcl Commands in StarRC Shell

Creating a GPD for Parasitic Explorer Tool Use

The StarRC user guide lists commands that are not supported for creating a GPD. If you use any unsupported commands during extraction, a GPD is not created and you cannot use the Parasitic Explorer tool.

To use the Parasitic Explorer tool, you must set `PARASITIC_EXPLORER_ENABLE_ANALYSIS: YES` during the extraction to ensure that the GPD contains necessary information.

Some StarRC commands are acceptable for creating a GPD, but are not compatible with the Parasitic Explorer tool. Observe the following guidelines:

- The `SHORT_PINS: NO` command is not supported.
- The `REDUCTION` command affects the values and locations of the reported parasitics. Set the command to `NO` or `LAYER_NO_EXTRA_LOOPS` for optimum correspondence of the parasitics to the input database.

Transistor-level GPDs intended for later use with the Parasitic Explorer tool must adhere to the following requirements:

- The `REMOVE_FLOATING_NETS` command must be set to `YES`.
- The `XREF` command must be set to `YES`.
- The `TRANSLATE_RETAIN_BULK_LAYERS` command must be set to `CONLY` to avoid creating multiple substrate nodes.
- The `XREF_LAYOUT_NET_PREFIX` command cannot specify a prefix that contains special characters. The default prefix of ln_ is recommended.

Saving Data for Displaying Layout Information Around Shorts

The Parasitic Explorer tool provides a user interface for displaying design objects in the vicinity of shorts discovered during extraction. By default, the StarRC tool does not save detailed information about every short.

To ensure that information about specific shorts is available for the Parasitic Explorer tool, you can create a file that contains the additional layout information for specified nets or regions. Use one of the following methods during the extraction:

- Use the `-write_short_regions` option with the `StarXtract` command. For example:

  ```
  %StarXtract -write_short_regions -nets_file file_name cmd_file
  ```

  The nets file contains a list of net names separated by spaces or line breaks.

- Specify a region of interest by using the `-window` option. The arguments *llx*, *lly*, *urx*, and *ury* are the lower-left x-coordinate, lower-left y-coordinate, upper-right x-coordinate, and upper-right y-coordinate. For example:

  ```
  %StarXtract -write_short_regions -window llx lly urx ury cmd_file
  ```

The `-nets_file` and `-window` options are mutually exclusive.

Saving Parasitic Resistor Attributes

The StarRC command file controls whether certain properties of parasitic resistors are stored in the GPD during extraction. If you want to examine these attributes with the Parasitic Explorer tool, observe the following guidelines:

- The `NETLIST_TAIL_COMMENTS: YES` command stores the following attributes:
  - is_via
  - is_via_array
  - length
  - width
- The `EXTRA_GEOMETRY_INFO: RES` command stores the following attributes:
  - x_coordinate_max
  - x_coordinate_min
  - y_coordinate_max
  - y_coordinate_min

- Running simultaneous multicorner extraction by using the `SIMULTANEOUS_MULTI_CORNER: YES` command stores the following attributes:
  - resistance_max
  - resistance_min
  - resistance_multicorner
- Running single-corner extraction stores the following attribute:
  - resistance

Using The Interactive StarRC Shell

The following procedure is a general outline of an interactive Parasitic Explorer session.

1. Use the StarRC tool to perform extraction and save parasitics in a GPD.

   You must include the `PARASITIC_EXPLORER_ENABLE_ANALYSIS: YES` command in the extraction command file.

2. Start the Parasitic Explorer tool by entering `starrc_shell` at the operating system prompt.

   ```
   % starrc_shell
   ```

3. If the GPD contains multiple corners, specify the corner name by setting the `parasitic_corner_name` variable:

   ```
   starrc_shell> set parasitic_corner_name corner_name
   ```

4. Read the parasitics from the GPD.

   ```
   starrc_shell> read_parasitics -keep_capacitive_coupling \
                 -format gpd gpd_directory
   ```

5. Specify the current design, which is the name used in the `BLOCK` command in the StarRC command file used for the extraction.

   ```
   starrc_shell> current_design design_name
   ```

6. Use Parasitic Explorer commands to find the parasitics associated with design objects.

   ```
   starrc_shell> get_coupling_capacitors ...
   starrc_shell> get_ground_capacitors ...
   starrc_shell> get_resistors ...
   ```

7. Use Tcl commands to examine the attributes of the parasitics.

   ```
   starrc_shell> report_attribute ...
   ```

8. Use Tcl commands to perform general functions such as storing parasitics into user variables, operating on those variables, and writing data into a custom report.

   ```
   starrc_shell> set aggr_cap ...
   starrc_shell> set new_cap [expr $aggr_cap ...
   starrc_shell> echo ...
   starrc_shell> puts ...
   ```

9. End the session with either of the following commands:

   ```
   starrc_shell> quit
   starrc_shell> exit
   ```

You can also create Tcl scripts to carry out complex or repetitive tasks.

Application Examples

These commands are examples of how to work with parasitic objects retrieved from a GPD and are not necessarily complete Tcl scripts.

Example 1

The following Tcl code finds wire segments with width less than 5 nm.

```
foreach_in_collection net [get_nets *] {
   foreach_in_collection res [get_resistors -of_objects $net]  {
      if { [get_attribute $res width] < 0.005 } {
         puts [format "Net:%s ResNodes:%d-%d Width:%g" \
            [get_attribute $net full_name] \
            [get_attribute $res node1_index] \
            [get_attribute $res node2_index] \
         ]
      }
   }
}
```

The output appears as follows:

```
Net:net1 ResNodes:1-2 Width:0.002
Net:net13 ResNodes:43-32 Width:0.0045
Net:net99 ResNodes:23-25 Width:0.001
```

Example 2

The following Tcl code finds the total net wire length by layer. Assume that variable $net is already set as in Example 1.

```
array set netLen {}
foreach_in_collection res [get_resistors -of_objects $net] {
   set res_lyr [get_attribute $res layer_name]
   set res_len [get_attribute $res length]
   if {[info exists netLen($res_lyr)]} {
     set $netLen($res_lyr) [expr {$res_len + $netLen($res_lyr)}]
   } else {
     set netLen($res_lyr) $res_len
   }
}
foreach key [array names netLen] {
   if {$netLen($key) > 0} {
      puts [format "(%s %g)" $key $netLen($key)]
   }
}
```

The output appears as follows:

```
(metal2 1.375)
(metal3 3.76)
(metal4 9.205)
```

Example 3

The following Tcl code finds the top 100 nets with the largest ratio of ground capacitance between parasitic corners.

```
array set gcap_ratio {}
foreach_in_collection net [get_nets *] {
   set gcap1 0
   set gcap2 0
   foreach_in_collection gcap [get_ground_capacitors -of_objects $net \
                              -parasitic_corners "cworst cbest"] {
      set gcap1 [expr $gcap1 + [lindex [get_attribute $gcap \
          capacitance] 0]]
      set gcap2 [expr $gcap2 + [lindex [get_attribute $gcap \
          capacitance] 1]]
   }
   set gcap_ratio([get_attribute $net name]) [expr $gcap1/$gcap2]
}

set cntr 0
foreach {net_name gcap_ratio} [eval {lsort -stride 2 -real -index 1 \
                           -decreasing [array get gcap_ratio]}] {
   puts "Net:$net_name Ratio:$gcap_ratio"
   incr cntr
   if {$cntr >= 100} {
      break
   }
}
```

The output appears as follows:

```
Net:net95 Ratio:122.875
Net:net284 Ratio:118.502
Net:net105 Ratio:91.18
...
```

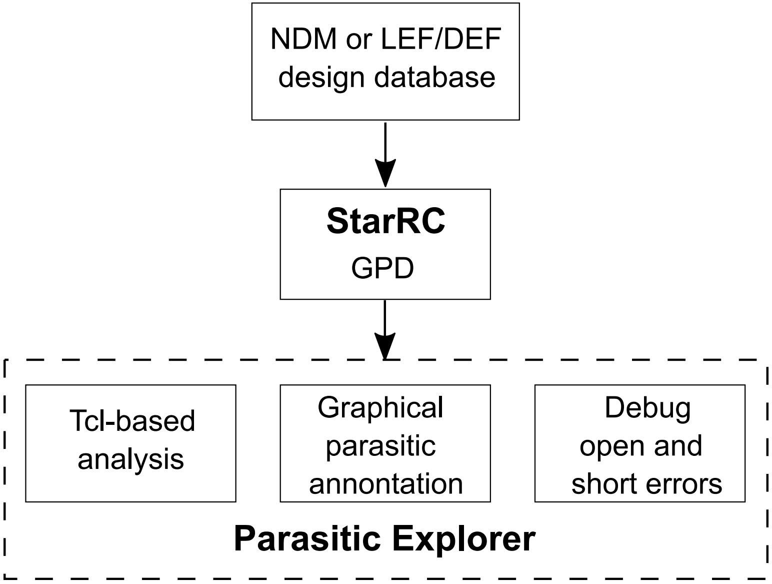
Analyzing and Debugging in Gate-Level Flow

You can analyze and debug RC elements for selected nets in the parasitic explorer gate-level flow.

In the gate-level flow, the Parasitic Explorer tool

- Provides an environment for advanced analysis of parasitics
- Supports the Tcl language with Synopsys Tcl extensions
- Provides a graphical environment to annotate parasitics and to debug open and short errors
- Uses the `starrc_shell` command

Figure 2 Parasitic Explorer Gate-Level Flow


NDM or LEF/DEF design database
StarRC
GPD
Tcl-based analysis
Graphical parasitic annontation
Debug open and short errors
Parasitic Explorer

For information to analyze and debug parasitics, see the following topics:

- Setting Up the Gate-Level Flow
- Displaying Parasitic Elements in a Layout View
- Viewing Open and Short Errors With the Error Browser GUI
- Managing Open and Short Errors Using Summary View
- Analyzing Open and Short Errors
- Reporting Power Net Names in Short Summary File

Setting Up the Gate-Level Flow

To setup a gate-level flow,

1. Run extraction using the following command:

   ```
   PARASITIC_EXPLORER_ENABLE_ANALYSIS: YES
   ```

2. Start the Parasitic Explorer tool by invoking the StarRC shell:

   ```
   % starrc_shell
   ```

3. Source the starrc_shell_init.tcl file to read the parasitics from the GPD and specify the current design:

   ```
   starrc_shell> source <gpd_directory>/starrc_shell_init.tcl
   ```

Example 1 Commands in the starrc_shell_init.tcl File

```
# Reads the parasitics
set gpd_read_remove_buslike_escape false
read_parasitics -keep_capacitive_coupling -format GPD <gpd_directory>

# Specifies the current design
current_design <design_name>
```

4. Source the starrc_shell_load_layout.tcl file to read the physical design database and check the physical database for consistency:

   ```
   starrc_shell> source <gpd_directory>/starrc_shell_load_layout.tcl
   ```

Example 2 Commands in the starrc_shell_load_layout.tcl File

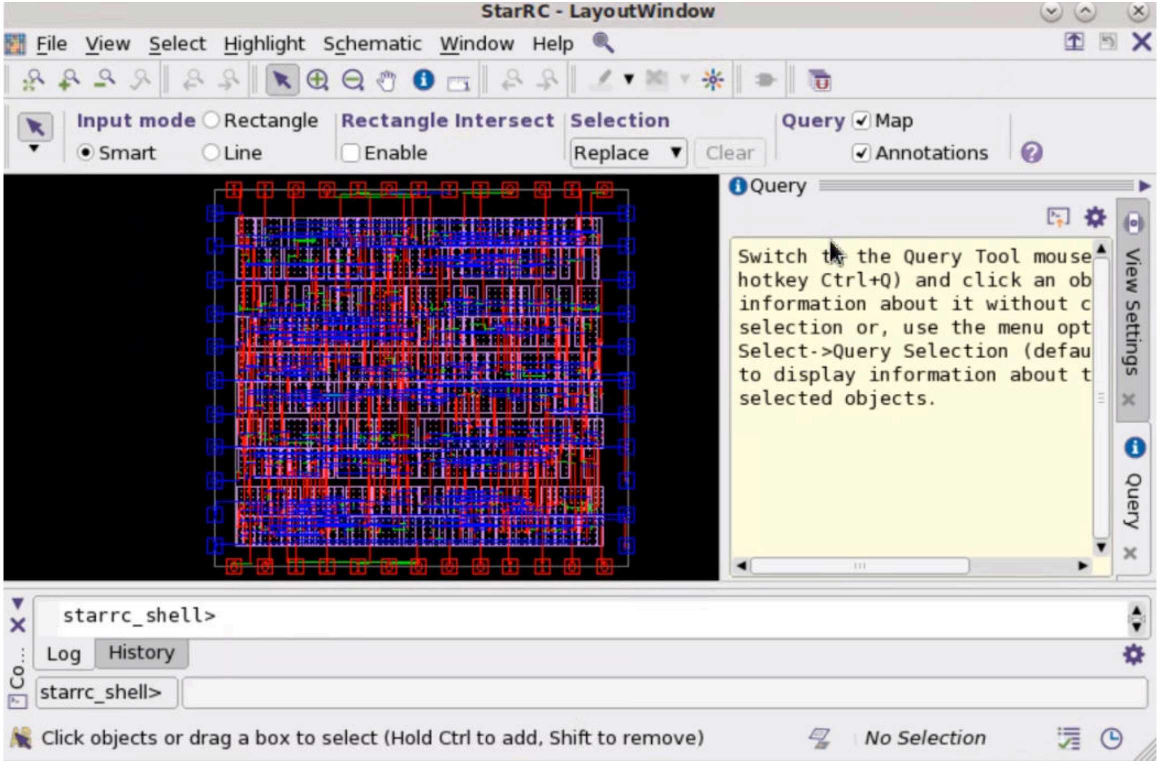
```
# Reads a design database
set_layout_database_options -physical_enable_clock_data  \
            -physical_lib_path {design_library_files}    \
            -physical_design_path {design_physicaldata_files}

# Checks the physical database for consistency
check_layout_database
```

5. Invoke the GUI. The StarRC - Layout window appears (Figure 3). The original terminal screen is still accessible.

```
starrc_shell> start_gui
```

Figure 3 StarRC Parasitic Explorer GUI Layout Window for Gate-Level Flow



```
Switch to the Query Tool mouse
hotkey Ctrl+Q) and click an ob
information about it without c
selection or, use the menu opt
Select->Query Selection (defau
to display information about t
selected objects.
```

```
starrc_shell>
```

```
starrc_shell>
```

Click objects or drag a box to select (Hold Ctrl to add, Shift to remove)

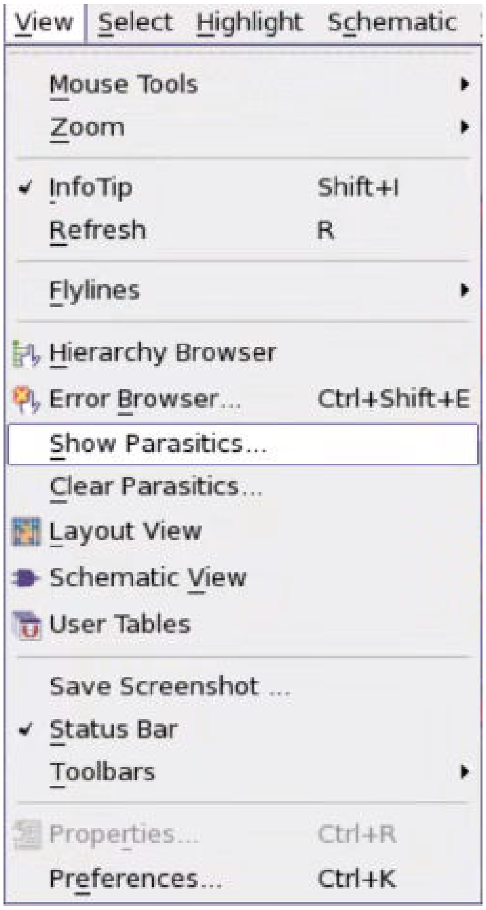
Displaying Parasitic Elements in a Layout View

For a gate-level flow, you can use a GUI to visualize the RC elements associated with selected nets in an NDM or LEF/DEF design database.

To display parasitic elements in a layout view,

1. Set up the gate-level flow (see Setting Up the Gate-Level Flow and Figure 3).
2. Click **View > Show Parasitics** (Figure 4).

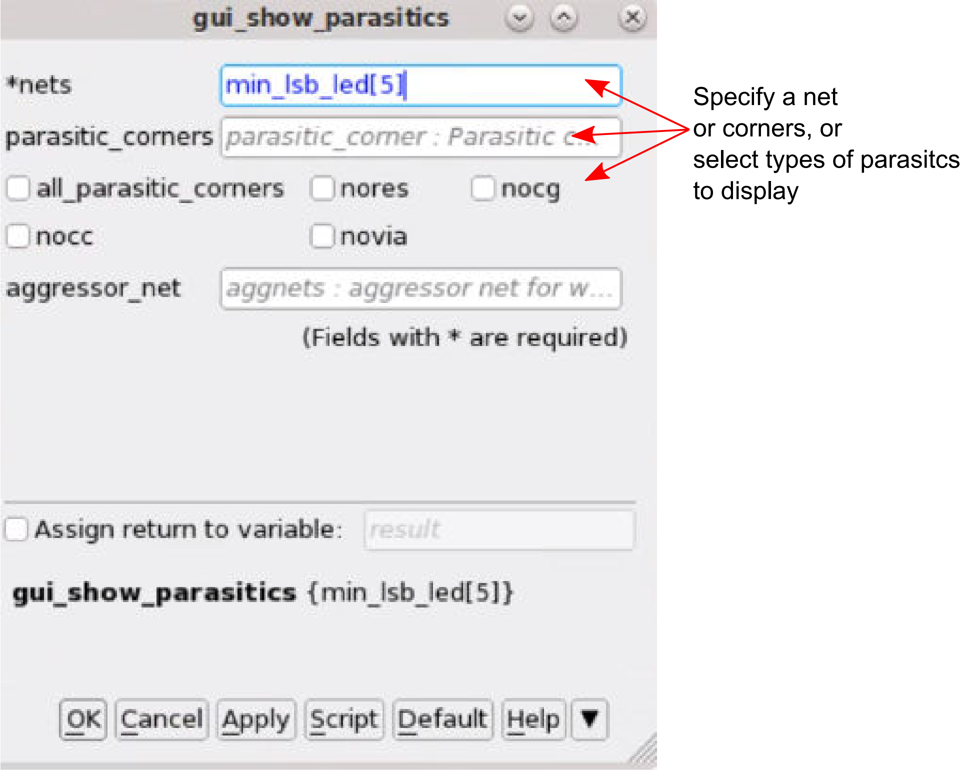
Figure 4 Show Parasitics



The gui_show_parasitics window appears (Figure 5).

3. Enter a net name and specify corners or select parasitics to display as needed (Figure 5).

Figure 5 The gui_show_parasitics Window



gui_show_parasitics

*nets min_lsb_led[5]

parasitic_corners parasitic_corner : Parasitic c...

□ all_parasitic_corners □ nores □ nocg

□ nocc □ novia

aggressor_net aggnets : aggressor net for w...

(Fields with * are required)

□ Assign return to variable: result

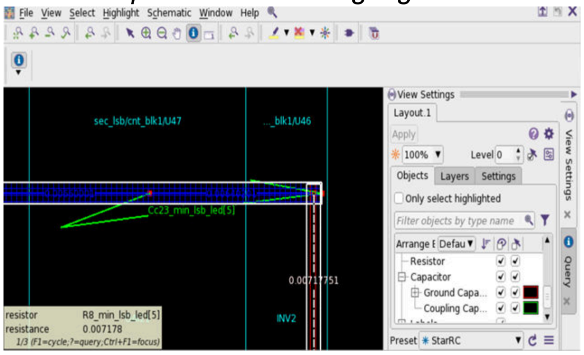
gui_show_parasitics {min_lsb_led[5]}

Specify a net
or corners, or
select types of parasitcs
to display

When you use the command line (Figure 43) to run `gui_show_parasitics` command, you can use options of the `gui_show_parasitics` command to restrict the displayed parasitics. For example, you can select a specific net, specify which corners to use, and disable the display of certain types of parasitics. See Chapter 4, Parasitic Explorer Command Reference for more information about the command.

4. Click **Apply** (Figure 5) to view the specified net (Figure 6 and Figure 10).

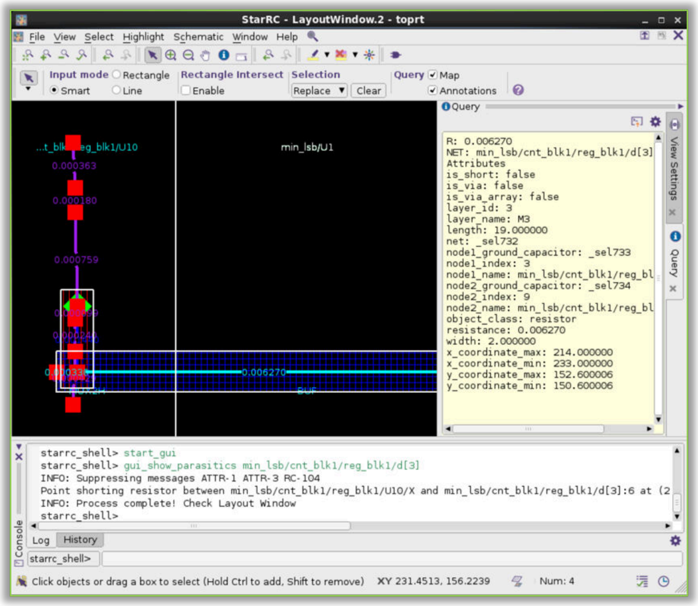
Figure 6 Specified Net is Highlighted



resistor R8_min_lsb_led[5]
resistance 0.007178
1/3 (F1=cycle;?=query;Ctrl+F1=focus)

5. Zoom in to the location of the net to view the annotated RC elements by using the Zoom tool (in the View menu) or the + keyboard shortcut. Flylines represent resistors, squares represent ground capacitors, and diamonds represent pin capacitors (Figure 7).

Figure 7 Annotated Parasitics


StarRC - LayoutWindow.2 - toprt
File View Select Highlight Schematic Window Help
Input mode ○ Rectangle ● Smart ○ Line
Rectangle Intersect □ Enable
Selection Replace Clear
Query ☑ Map ☑ Annotations
Query
View Settings
...t_blk1/reg_blk1/U10
min_lsb/U1
0.000363
0.000180
0.000759
0.006270
BUF
Console
Log
History

```
R: 0.006270
NET: min_lsb/cnt_blk1/reg_blk1/d[3]
Attributes
is_short: false
is_via: false
is_via_array: false
layer_id: 3
layer_name: M3
length: 19.000000
net: _sel732
node1_ground_capacitor: _sel733
node1_index: 3
node1_name: min_lsb/cnt_blk1/reg_bl
node2_ground_capacitor: _sel734
node2_index: 9
node2_name: min_lsb/cnt_blk1/reg_bl
object_class: resistor
resistance: 0.006270
width: 2.000000
x_coordinate_max: 214.000000
x_coordinate_min: 233.000000
y_coordinate_max: 152.600006
y_coordinate_min: 150.600006
```

```
starrc_shell> start_gui
starrc_shell> gui_show_parasitics min_lsb/cnt_blk1/reg_blk1/d[3]
INFO: Suppressing messages ATTR-1 ATTR-3 RC-104
Point shorting resistor between min_lsb/cnt_blk1/reg_blk1/U10/X and min_lsb/cnt_blk1/reg_blk1/d[3]:6 at (2
INFO: Process complete! Check Layout Window
starrc_shell>
```

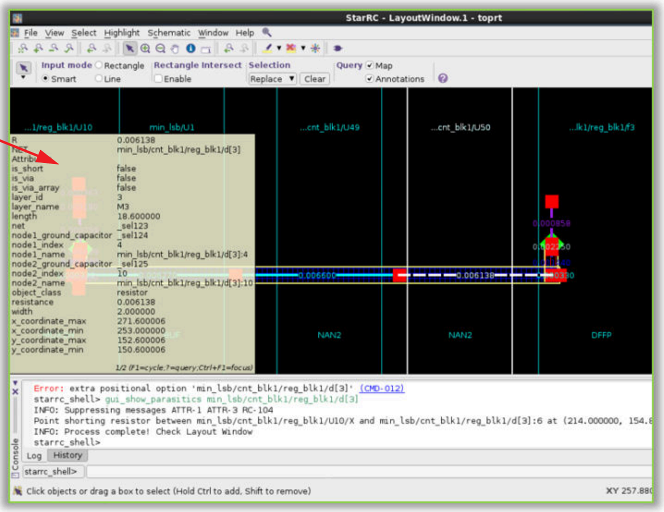
starrc_shell>

Click objects or drag a box to select (Hold Ctrl to add, Shift to remove) XY 231.4513, 156.2239 Num: 4

6. Hover the pointer over a parasitic element to display the element attributes (Figure 8).

Figure 8 Annotated Parasitics With Attribute Display

Attribute display


StarRC - LayoutWindow.1 - toprt
File View Select Highlight Schematic Window Help
Input mode ○ Rectangle ● Smart ○ Line
Rectangle Intersect □ Enable
Selection Replace Clear
Query ☑ Map ☑ Annotations
...1/reg_blk1/U10
min_lsb/U1
...cnt_blk1/U49
...cnt_blk1/U50
...lk1/reg_blk1/f3
0.006600
0.006138
NAN2
NAN2
DFFP
Console
Log
History

```
R                          0.006138
NET                        min_lsb/cnt_blk1/reg_blk1/d[3]
Attributes
is_short                   false
is_via                     false
is_via_array               false
layer_id                   3
layer_name                 M3
length                     18.600000
net                        _sel123
node1_ground_capacitor     _sel124
node1_index                4
node1_name                 min_lsb/cnt_blk1/reg_blk1/d[3]:4
node2_ground_capacitor     _sel125
node2_index                10
node2_name                 min_lsb/cnt_blk1/reg_blk1/d[3]:10
object_class               resistor
resistance                 0.006138
width                      2.000000
x_coordinate_max           271.600006
x_coordinate_min           253.000000
y_coordinate_max           152.600006
y_coordinate_min           150.600006
                           1/2 (F1=cycle;?=query;Ctrl+F1=focus)
```

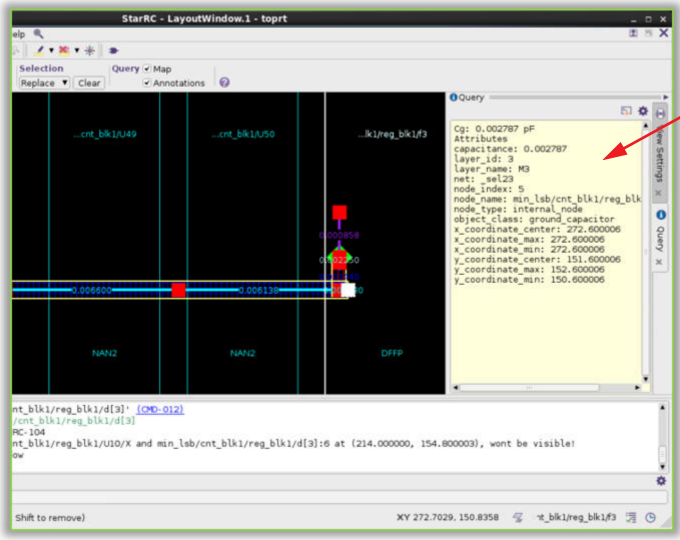
```
Error: extra positional option 'min_lsb/cnt_blk1/reg_blk1/d[3]' (CMD-012)
starrc_shell> gui_show_parasitics min_lsb/cnt_blk1/reg_blk1/d[3]
INFO: Suppressing messages ATTR-1 ATTR-3 RC-104
Point shorting resistor between min_lsb/cnt_blk1/reg_blk1/U10/X and min_lsb/cnt_blk1/reg_blk1/d[3]:6 at (214.000000, 154.8
INFO: Process complete! Check Layout Window
starrc_shell>
```

```
starrc_shell>
```

Click objects or drag a box to select (Hold Ctrl to add, Shift to remove)   XY 257.880

7. Left-click on an element to populate the **Query** pane with the element attributes (Figure 9).

Figure 9 Annotated Parasitics With Attributes in the Query Pane



Query pane

```
Cg: 0.002787 pF
Attributes
capacitance: 0.002787
layer_id: 3
layer_name: M3
net: _sel23
node_index: 5
node_name: min_lsb/cnt_blk1/reg_blk
node_type: internal_node
object_class: ground_capacitor
x_coordinate_center: 272.600006
x_coordinate_max: 272.600006
x_coordinate_min: 272.600006
y_coordinate_center: 151.600006
y_coordinate_max: 152.600006
y_coordinate_min: 150.600006
```

```
nt_blk1/reg_blk1/d[3]' (CMD-012)
/cnt_blk1/reg_blk1/d[3]
RC-104
nt_blk1/reg_blk1/U10/X and min_lsb/cnt_blk1/reg_blk1/d[3]:6 at (214.000000, 154.800003), wont be visible!
ow
```

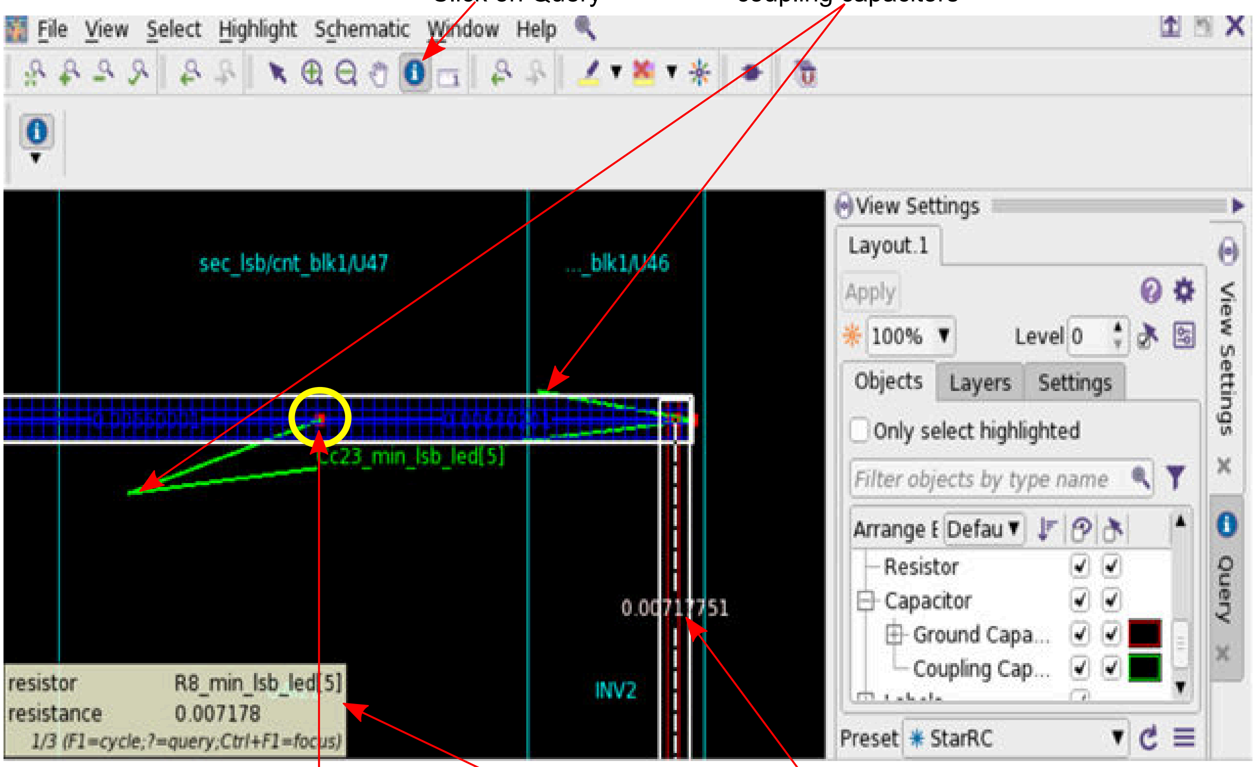
Shift to remove)   XY 272.7029, 150.8358   nt_blk1/reg_blk1/f3

8. Use the **Query** icon (Figure 10) to query resistance, ground capacitance, and coupling capacitance and view design and net parasitics after choosing **Show Parasitics** (Figure 4). Also, click on the following tabs to select and deselect check box to view appropriate types of parasitics for the specified net:

   ◦ **Query**: Displays information of resistor and capacitor with ground capacitance and coupling capacitance.

   ◦ **View Settings**: Displays layer and setting information.

Figure 10 Query Icon, and View Settings and Query Tabs



Click on Query

Green flylines indicate coupling capacitors

```
resistor      R8_min_lsb_led[5]
resistance    0.007178
  1/3 (F1=cycle;?=query;Ctrl+F1=focus)
```

Red dot indicates ground capacitance

White border indicates resitor and displays the information in a yellow box

9. Clear the parasitics with the `gui_clear_parasitics` command.

```
starrc_shell> gui_clear_parasitics
```

10. When you are done examining the parasitic elements, close the GUI window.

11. Exit the StarRC shell session with the `quit` or `exit` command.

    ```
    starrc_shell> quit
    ```

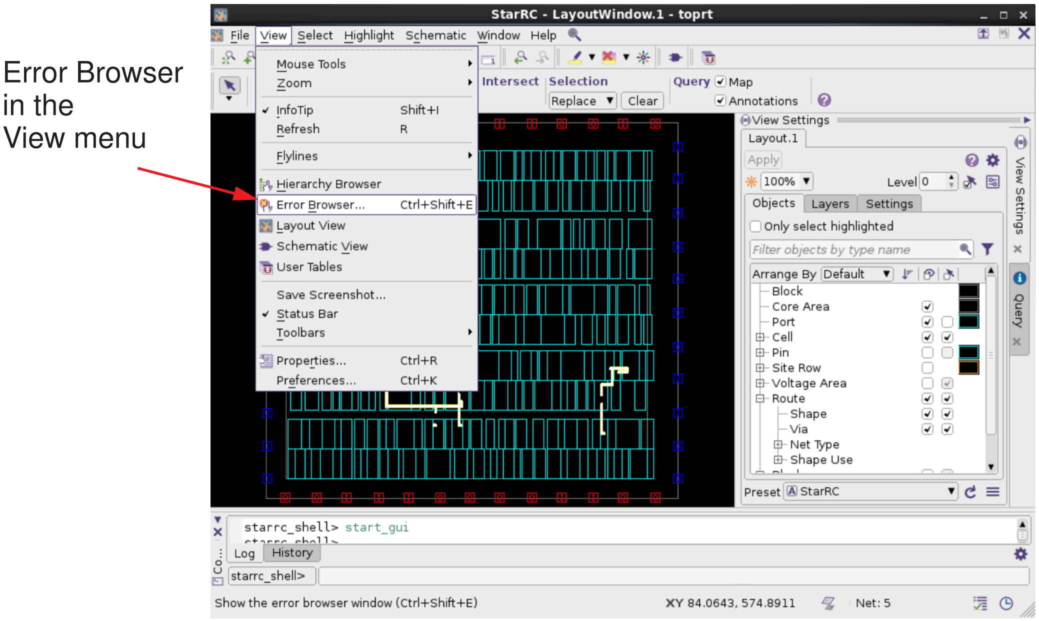
Viewing Open and Short Errors With the Error Browser GUI

For a gate-level flow, you can use the Parasitic Explorer error browser to examine opens and shorts found by the StarRC tool during extraction.

The general procedure for using the error browser GUI is as follows:

1. Set up the gate-level flow (see Setting Up the Gate-Level Flow and Figure 3).
2. Choose **View > Error Browser** (Figure 11).

Figure 11 Error Browser Selection



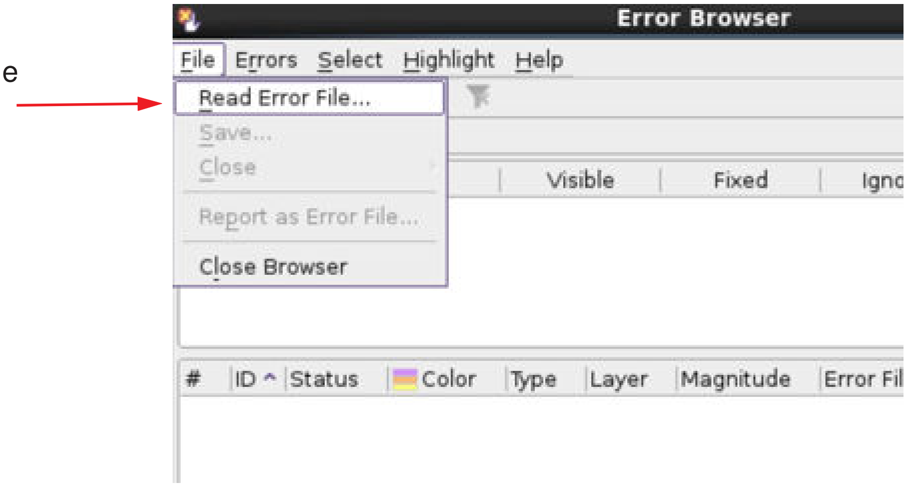
```
starrc_shell> start_gui
starrc_shell>
```

Show the error browser window (Ctrl+Shift+E)

3. Choose **File > Read Error File** (Figure 12).

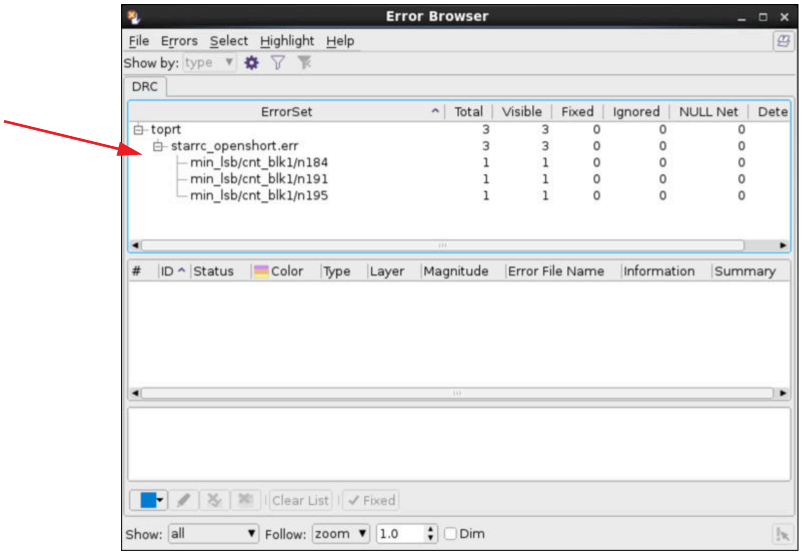
   The **Error Browser** dialog box appears. Select an error file; the default name is starrc_openshort.err. A list of nets with opens and shorts appears in the upper pane (Figure 13).

Figure 12 Reading an Error File



Read Error File
in the
File menu

Figure 13 List of Nets With Opens and Shorts



Show by: type

ErrorSet	Total	Visible	Fixed	Ignored	NULL Net	Dete
toprt	3	3	0	0	0	
starrc_openshort.err	3	3	0	0	0	
min_lsb/cnt_blk1/n184	1	1	0	0	0	
min_lsb/cnt_blk1/n191	1	1	0	0	0	
min_lsb/cnt_blk1/n195	1	1	0	0	0	

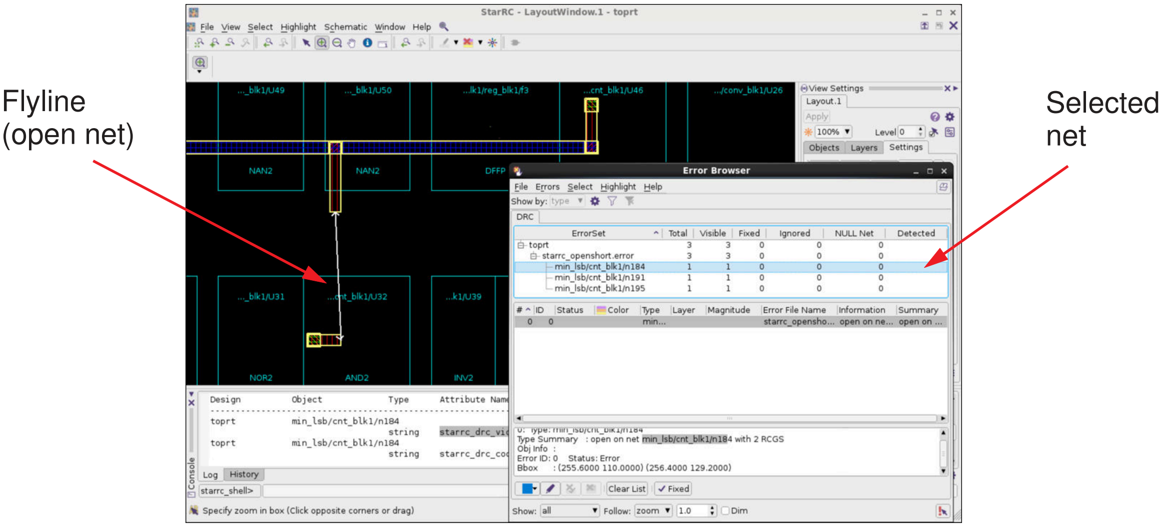
Show: all Follow: zoom 1.0 □ Dim

Nets that
have opens
or shorts

4. Select a net from the list in the **Error Browser** dialog box and click **Apply**.

   The selected net is displayed (Figure 14 for an open net. A flyline indicates the location of the open error.

Figure 14 Open Net Display



Flyline
(open net)

Selected
net

ErrorSet	Total	Visible	Fixed	Ignored	NULL Net	Detected
toprt	3	3	0	0	0	
starrc_openshort.error	3	3	0	0	0	
min_lsb/cnt_blk1/n184	1	1	0	0	0	
min_lsb/cnt_blk1/n191	1	1	0	0	0	
min_lsb/cnt_blk1/n195	1	1	0	0	0	

#	ID	Status	Color	Type	Layer	Magnitude	Error File Name	Information	Summary
0	0			min...			starrc_opensho...	open on ne...	open on ...

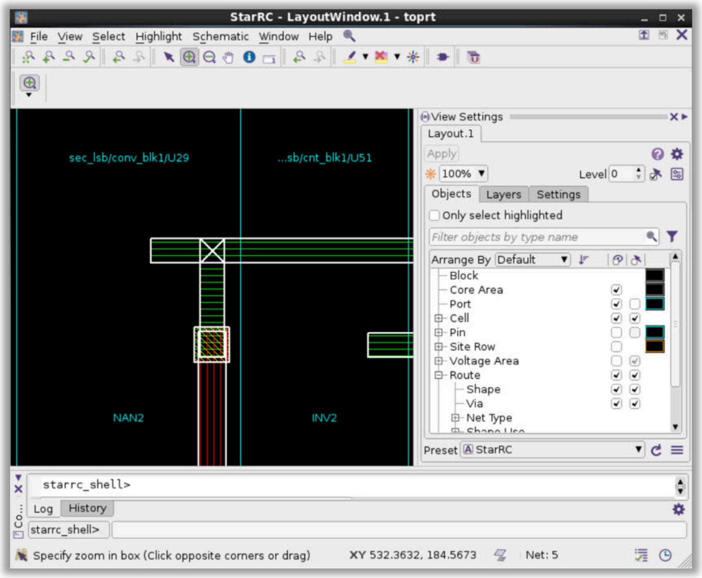
```
0:  Type: min_lsb/cnt_blk1/n184
Type Summary   : open on net min_lsb/cnt_blk1/n184 with 2 RCGS
Obj Info  :
Error ID: 0    Status: Error
Bbox      : (255.6000 110.0000) (256.4000 129.2000)
```

```
Design        Object                   Type      Attribute Name
--------------------------------------------------------------
toprt         min_lsb/cnt_blk1/n184
                                       string    starrc_drc_vio
toprt         min_lsb/cnt_blk1/n184
                                       string    starrc_drc_coo
```

Specify zoom in box (Click opposite corners or drag)

A shorted net appears (Figure 15).

Figure 15 Shorted Net Display



```
starrc_shell>
```

Specify zoom in box (Click opposite corners or drag) XY 532.3632, 184.5673 Net: 5

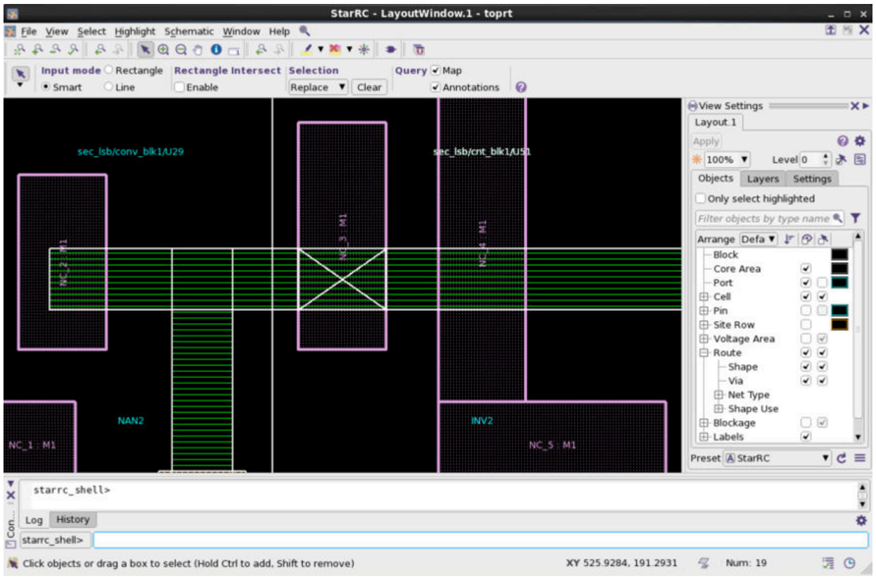
5. To examine and debug shorts, select a shorted net from the error browser. An X appears on the layout at the location of the short. If a net is shorted in multiple locations, each short is listed in the error browser. You can navigate through the shorts by clicking on them in the error browser.

6. You can also select a net by name. In the layout window, choose **Select > By Name**. In the **Select by Name** dialog box, select the design object type and enter a name in the **Name** field.

7. Display the noncritical material in the region immediately surrounding the short (Figure 16 by using the following command:

   ```
   starrc_shell> gui_show_short_regions -gpd <gpd_dir>
   ```

Figure 16 Shorted Net Display With Nearby Noncritical Material



starrc_shell>

starrc_shell>

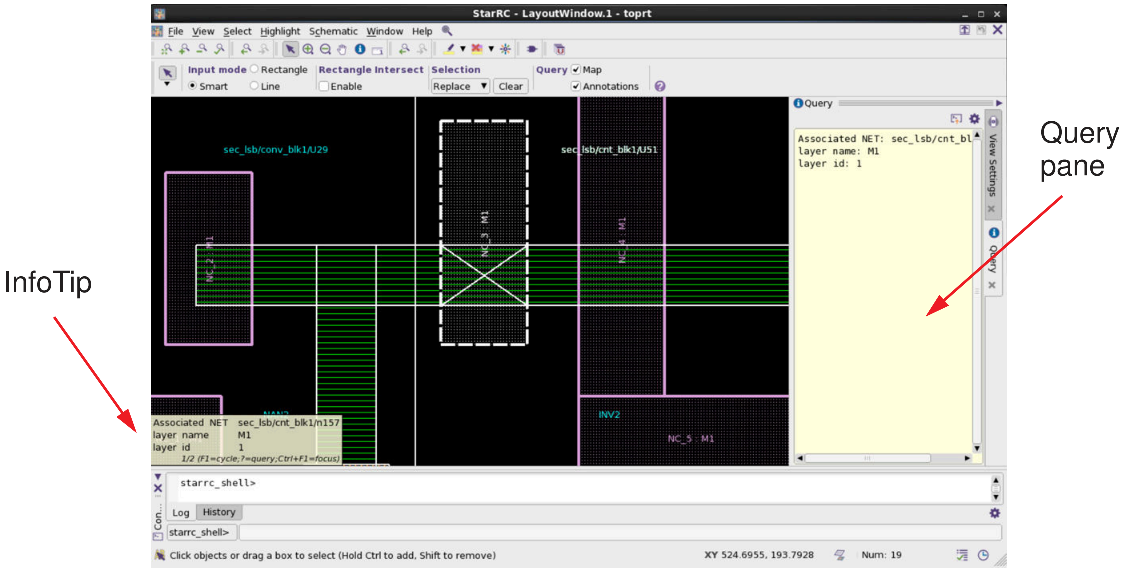
Click objects or drag a box to select (Hold Ctrl to add, Shift to remove)

XY 525.9284, 191.2931

Num: 19

You can view the net name and layer information of every shape in the short region by clicking on the object and looking at the InfoTip or the **Query** pane (Figure 17).

Figure 17 Shorted Net Display With Query Information



```
Associated NET: sec_lsb/cnt_bl
layer name: M1
layer id: 1
```

```
Associated NET   sec_lsb/cnt_blk1/n157
layer name       M1
layer id         1
   1/2 (F1=cycle;?=query;Ctrl+F1=focus)
```

```
starrc_shell>
```

Click objects or drag a box to select (Hold Ctrl to add, Shift to remove)   XY 524.6955, 193.7928   Num: 19

For more examples to view open and short errors using Tcl command, see starrc_gpd_read_opens_shorts.

8. When you are done examining the nets, close the GUI window.
9. Exit the StarRC shell session with the `quit` or `exit` command.

```
starrc_shell> quit
```

See Also

- Analyzing Open and Short Errors
- Managing Open and Short Errors Using Summary View
- starrc_gpd_read_opens_shorts

Managing Open and Short Errors Using Summary View

When you create a GPD with the PARASITIC_EXPLORER_ENABLE_ANALYSIS: YES command, the tool generates the following files:

- shorts_all.sum: Generated by the StarRC extraction tool where the shorts types are categorized.
- starrc_shell_error_summary_view.tcl: Automatically generates the Tcl file to view the heat map of all errors, including open and short errors.

When you source the Tcl file using the following command, the tool reads the physical data from LEF/DEF or NDM design for the GUI along with GPD parasitics and then opens the GUI and displays the summary view (Figure 18).

```
starrc_shell> source <gpd_directory>/my_summary_view.tcl
```

Example 3 Commands in a Tcl File to Read a Design Database

```
# Reads the parasitics
set gpd_read_remove_buslike_escape false
read_parasitics -keep_capacitive_coupling -format GPD <gpd_directory>

# Specifies the current design
current_design <design_name> -only_link_in_pe

# Reads a design database
set_layout_database_options -physical_enable_clock_data  \
            -physical_lib_path {design_library_files}    \
            -physical_design_path {design_physicaldata_files}

# Checks the physical database for consistency
check_layout_database

start_gui

# Reads the opens and shorts information to display the summary view
starrc_gpd_read_opens_shorts -gpd <gpd_dir> -summary_view
```

Figure 18 Summary View Shows Layer and X Markers in Distinct Colors

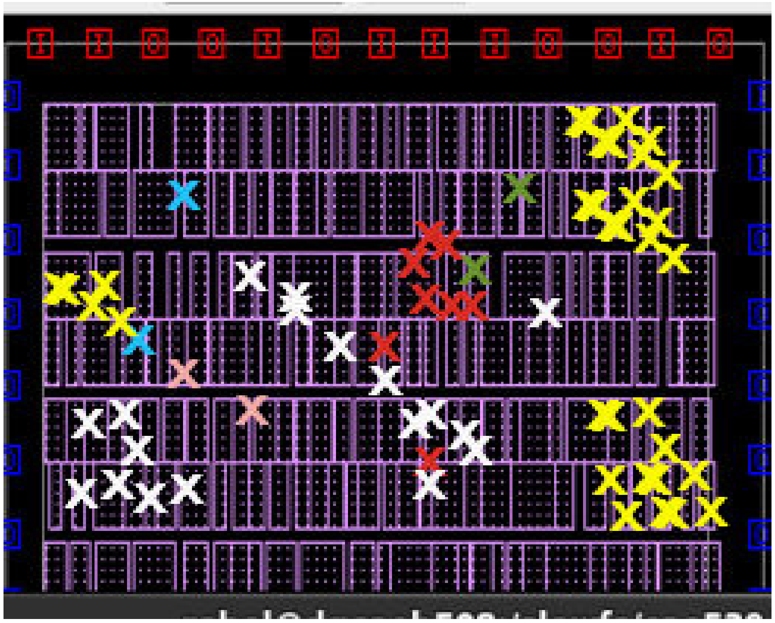


Table 2 lists the shorts error types and the respective color of X markers to categorize and prioritize shorts and open errors. Figure 18 shows X markers in the summary view.

Table 2 Shorts and Open Error Types With Color of X Markers

Error type	Color
Short to net	Red
Short to unselected net	Orange
Short to unselected net (power nets)	Yellow
Short to skip cell	Green
Short to fill	Cyan
Short to blockage	Pink
Open error	White

For more examples to view open and short errors using Tcl command, see starrc_gpd_read_opens_shorts.

Feedback

See Also

- Analyzing Open and Short Errors
- Viewing Open and Short Errors With the Error Browser GUI
- Reporting Power Net Names in Short Summary File

Analyzing Open and Short Errors

To analyze open and short errors of a large design,

- Generate a heat map by sourcing the starrc_shell_error_summary_view.tcl file to display in the summary view that helps to
    - Quickly view all shorts and opens error
    - Identify areas showing many errors
    - Focus on errors with the `-type`, `-short_types`, or `-window` option
    - Categorize and prioritize shorts errors with distinct color of X markers for each type of shorts error, as shown in Table 2
- Generate an error file with the `starrc_gpd_read_opens_shorts` command, as shown in Example 3, that helps to
    - Sort shorts and opens errors
    - Focus on shorts and opens errors with the `-type`, `-short_types`, or `-window` option
    - Narrow down the selected types of shorts to debug using the `-short_types` option

Example 4 Generating Error file (.err) to Use in the Error Browser GUI

```
starrc_shell> starrc_gpd_read_opens_shorts -gpd my.gpd -type short \
        -window 55,1634,1825,2175 -short_types (net unselectable \
                            nonselected skip_cell fill blockage)
        -error_file my_wrapper.err

****************************************
Report : Error counts
****************************************
Short errors : 19292
  short to net              : 12079
  short to fill             : 358
  short to blockage         : 6816
  short to unselectable net : 39

starrc_shell> ls -lh my_wrapper.err
3.8G my_wrapper.err
```

See Also

- Managing Open and Short Errors Using Summary View
- Viewing Open and Short Errors With the Error Browser GUI
- starrc_gpd_read_opens_shorts

Reporting Power Net Names in Short Summary File

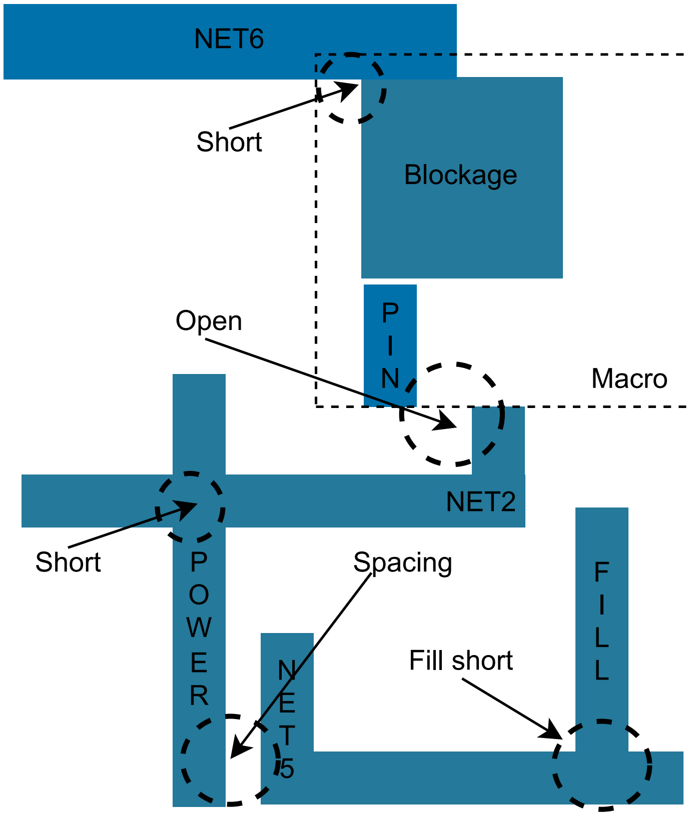
The Parasitic Explorer tool reports shorts from *extracted signal nets to a non-extracted power net*, even if you have set the `POWER_EXTRACT` command to `NO`. To generate this report, you need to set the `ENHANCED_SHORT_REPORTING` command to either `YES` or `COMPLETE`.

The tool reports power net names in the following format:

```
Short between net {net name} and power net {power net name} Layer = {}
 BBox={}
```

Example 5 shows a portion of a report for the net structure shown in Figure 19.

Figure 19   Identifies Power Nets Between Short NET4 and Open NET1



Example 5   Reports Shorts From Extracted Signal Nets to Non-Extracted Power Net

```
Short between NET6 and power net vss Layer=M6 Bbox=(447.052,436.477), \
(447.097,436.477)
Open between NET2 and power net vss Layer=M6 Bbox=(447.052,436.477), \
(447.097,436.477)
```

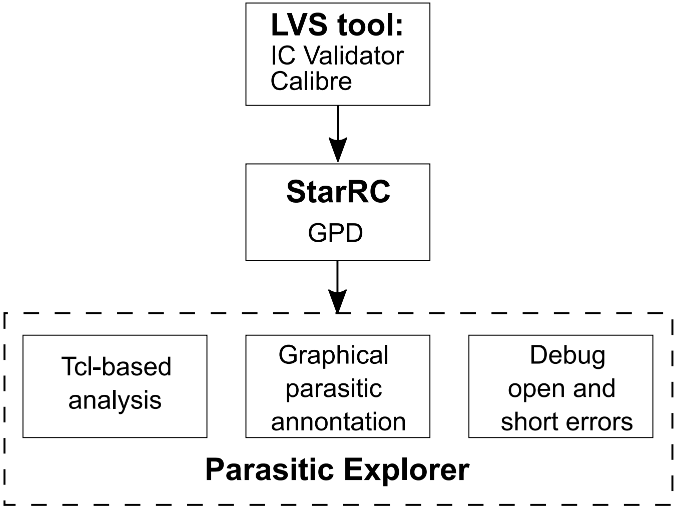
Analysing and Debugging in Transistor-Level Flow

You can view, analyze, and debug parasitics and open and short errors for selected nets in the parasitic explorer transistor-level flow.

In the transistor-level flow, the Parasitic Explorer tool

- Provides an environment for advanced analysis of parasitics for gate-level and transistor-level extraction flows
- Supports the Tcl language with Synopsys Tcl extensions
- Provides a graphical environment to annotate parasitics and to debug open and short errors

Figure 20 Parasitic Explorer Transistor-Level Flow



For information to analyze and debug parasitics, see the following topics:

- Accessing the Interoperable Process Design Kit (iPDK)
- Setting Up the Transistor-Level Flow
- Loading and Analyzing GPD Parasitics
- Viewing and Analyzing Open and Short Errors
- Using Parasitic Explorer From the Virtuoso Tool

Accessing the Interoperable Process Design Kit (iPDK)

For a transistor-level extraction flow, you need the iPDK to create and setup OpenAccess (OA) libraries and the lib.def file. The iPDK includes the following information to create schematics and layout for a design:

- Parameterized cells (PCell) for layout instantiation of circuit devices
- Symbols for circuit design and schematic creation
- Callbacks to calculate device parameters
- Technology files to define design rules, connectivity information, and layers to use in the layout
- Additional information to enable advanced features based on process nodes and user requirements

For information to access and install the iPDK, contact your vendor or Synopsys support.

Defining Libraries for an OpenAccess View

To define libraries using iPDK,

1. Install the iPDK provided by your vendor.
2. Copy the cds.lib file into the lib.defs file, as shown by the following command:

   ```
   cp cds.libs lib.defs
   ```

   Note:

   Save the lib.defs file in your working directory.

For detailed information about iPDK and setting up the lib.def and technology files, see the Custom Compiler documentation on SolvNetPlus.

Setting Up the Transistor-Level Flow

For a transistor-level parasitic explorer flow, you need both GPD and OpenAccess (OA) view.

The following general procedure is as follows:

1. List the commands in the StarRC command file as shown in Example 6 to create both GPD and an OA view in one run.

Example 6   Creating OpenAccess View

```
# Creates and saves a GPD
REDUCTION:NO
XREF:YES
EXTRA_GEOMETRY_INFO: NODE RES
NETLIST_TAIL_COMMENTS: YES
PARASITIC_EXPLORER_ENABLE_ANALYSIS: YES

# Creates an OpenAccess view
OA_LIB_DEF: TECHLIB/lib.defs
OA_LIB_NAME: my_library_OA
OA_CELL_NAME: TOP_CEL
OA_VIEW_NAME: starrc_physical_view
OA_PHYSICAL_ONLY_VIEW: YES
NETLIST_FORMAT: OA
```

2. Start the Parasitic Explorer tool by invoking the StarRC shell:

```
% starrc_shell
```

3. Source the starrc_shell_init.tcl file to read the parasitics from the GPD and specify the current design:

```
starrc_shell> source <GPD_DIR>/starrc_shell_init.tcl
```

Example 7   Tcl File to Read GPD and Specify Current Design

```
# Commands in *.tcl file
set gpd_read_remove_buslike_escape false
read_parasitics -keep_capacitive_coupling -format GPD <GPD_DIR>

current_design <design_name>
```

4. Set the `SYNOPSYS_FEATURE_GPD_OPEN_SHORT` environment variable to `1`:

```
setenv SYNOPSYS_FEATURE_GPD_OPEN_SHORT 1
```

Note:

Set the environment variable before you use the `starrc_explorer &` command. Otherwise, the GUI might not display the menus correctly.

5. Set the existing Custom Compiler shell (custom_shell) at the Unix path as shown in the following example:

```
% set path = (/global/apps/customcompiler_2020.12-SP1/bin $path)
```

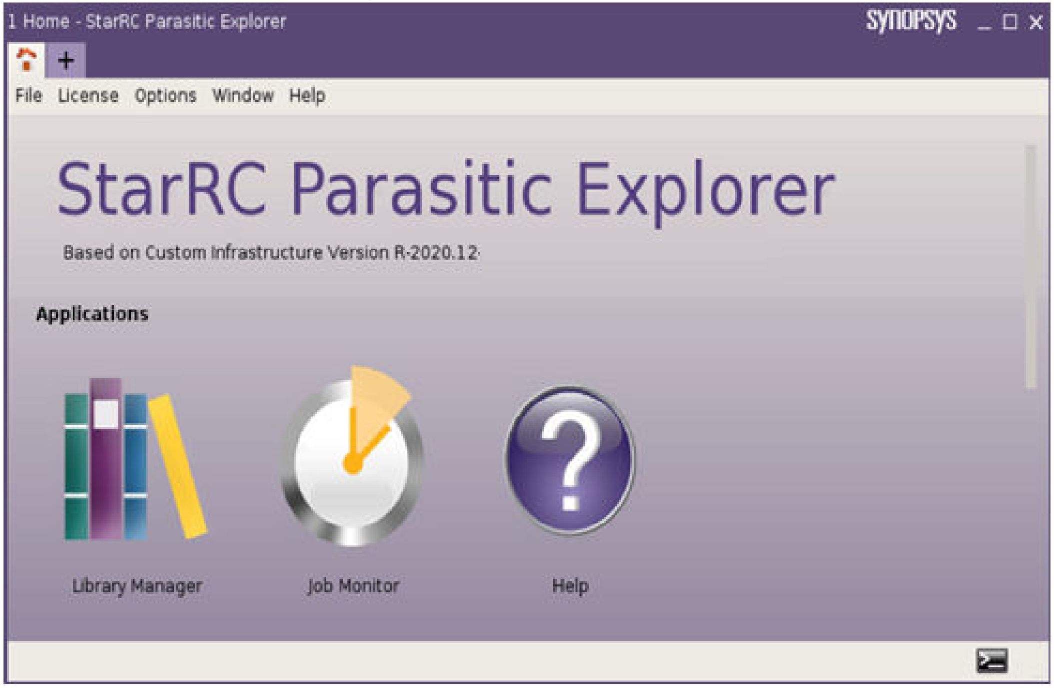
Or

```
% module load customcompiler
```

6. Start StarRC Parasitic Explorer using the OA view:

```
% starrc_explorer &
```

Figure 21 StarRC Parasitic Explorer GUI Window for Transistor-Level Flow



1 Home - StarRC Parasitic Explorer
SYNOPSYS
File License Options Window Help
StarRC Parasitic Explorer
Based on Custom Infrastructure Version R-2020.12
Applications
Library Manager
Job Monitor
Help

7. Click Library Manager to open the Layout Editor window.

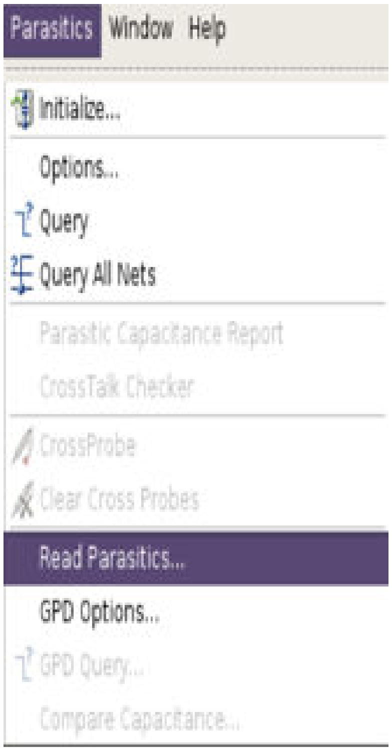
Loading and Analyzing GPD Parasitics

To view, highlight, and query resistance, coupling ground, and coupling capacitance and to analyze the uploaded GPD parasitics for a specific net:

1. Start the GUI and click Library Manager to open the Layout Editor window (see Setting Up the Transistor-Level Flow and Figure 21).
2. Click **Parasitics > Read Parasitics**.

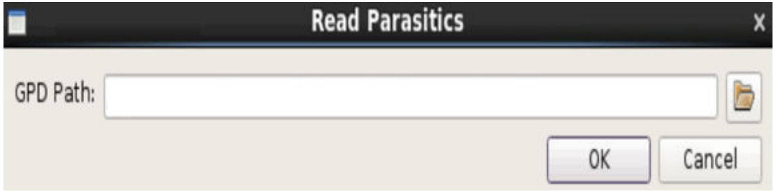
   The Read Parasitics dialog box appears (Figure 23).

Figure 22 Read Parasitics Menu



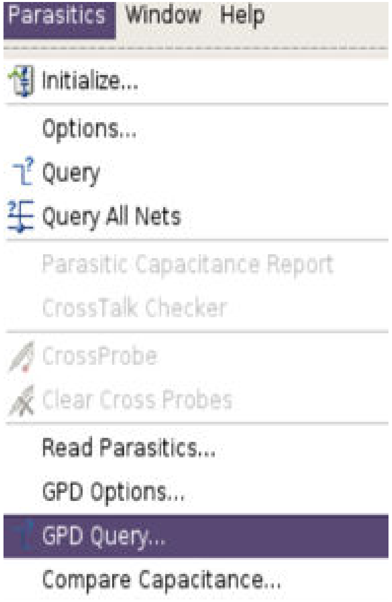
3. Select a GPD directory from your local folder in the **GPD Path** box (Figure 23).

Figure 23 Read Parasitics Dialog Box



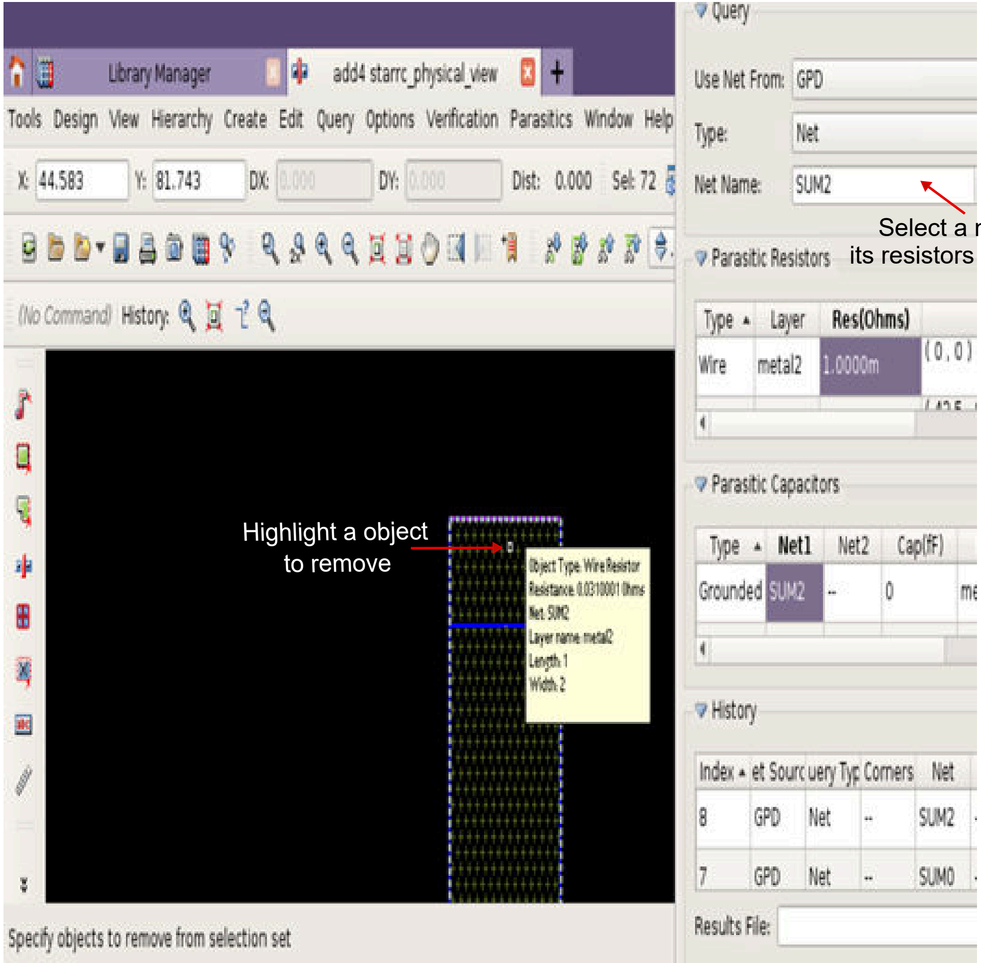
4. Click **OK** to upload the selected GPD directory.
5. Click **Parasitics > GPD Query...** (Figure 24).

Figure 24 GPD Query Menu



6. Select a net from the list to display all resistors and capacitors and highlight a resistor or capacitor segment to analyze RC elements (Figure 25).

Figure 25 Highlighting Resistor Segment



X: 44.583 Y: 81.743 DX: 0.000 DY: 0.000 Dist: 0.000 Sel: 72

Object Type: Wire Resistor
Resistance: 0.0310001 Ohms
Net: SUM2
Layer name: metal2
Length: 1
Width: 2

Specify objects to remove from selection set

Use Net From: GPD

Type: Net

Net Name: SUM2

Type	Layer	Res(Ohms)	
Wire	metal2	1.0000m	(0 , 0)

Type	Net1	Net2	Cap(fF)	
Grounded	SUM2	--	0	me

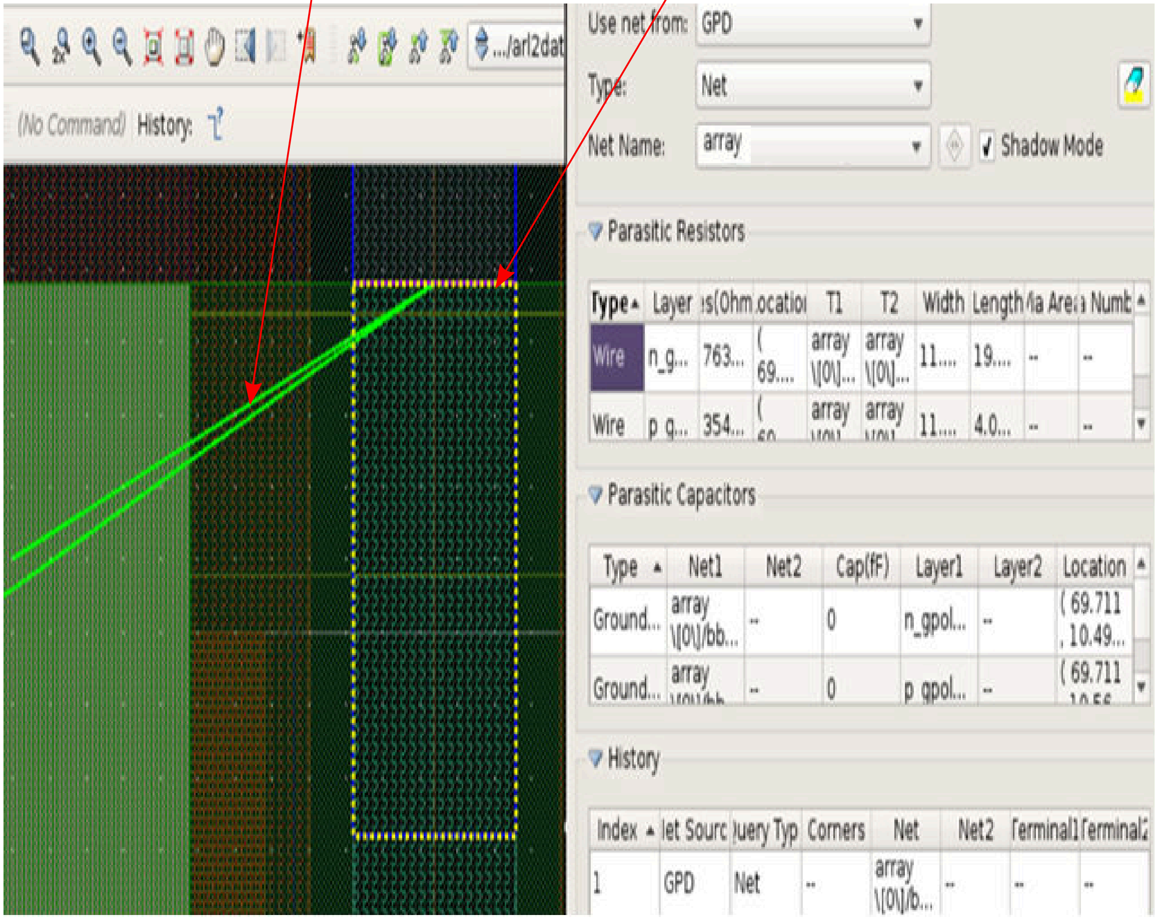
Index	et Sourc	uery Typ	Corners	Net
8	GPD	Net	--	SUM2
7	GPD	Net	--	SUM0

Results File:

Highlight a object
to remove

Select a net to display
its resistors and capacitors

Figure 26 Green Flylines Indicate Coupling Capacitors



Green flylines indicate coupling capaciotrs

Resistor segment highlighted

Use net from: GPD

Type: Net

Net Name: array

☑ Shadow Mode

Parasitic Resistors

Type	Layer	s(Ohm	ocatio	T1	T2	Width	Length	'ia Are	Numb
Wire	n_g...	763...	(69....	array \[0\]...	array \[0\]...	11....	19....	--	--
Wire	p_g...	354...	(	array	array	11....	4.0...	--	--

Parasitic Capacitors

Type	Net1	Net2	Cap(fF)	Layer1	Layer2	Location
Ground...	array \[0\]/bb...	--	0	n_gpol...	--	(69.711 , 10.49...
Ground...	array	--	0	p_gpol...	--	(69.711

History

Index	let Sourc	)uery Typ	Corners	Net	Net2	Terminal1	Terminal2
1	GPD	Net	--	array \[0\]/b...	--	--	--

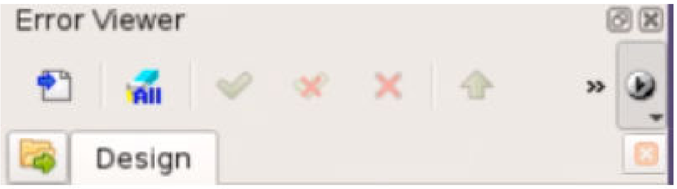
Viewing and Analyzing Open and Short Errors

To analyze view, highlight, and analyze open and short errors for a specific net found by the StarRC tool during extraction:

1. Start the GUI and click Library Manager to open the Layout Editor window (see Setting Up the Transistor-Level Flow and Figure 21).
2. Click **Windows > Assistants > Error Viewer**.

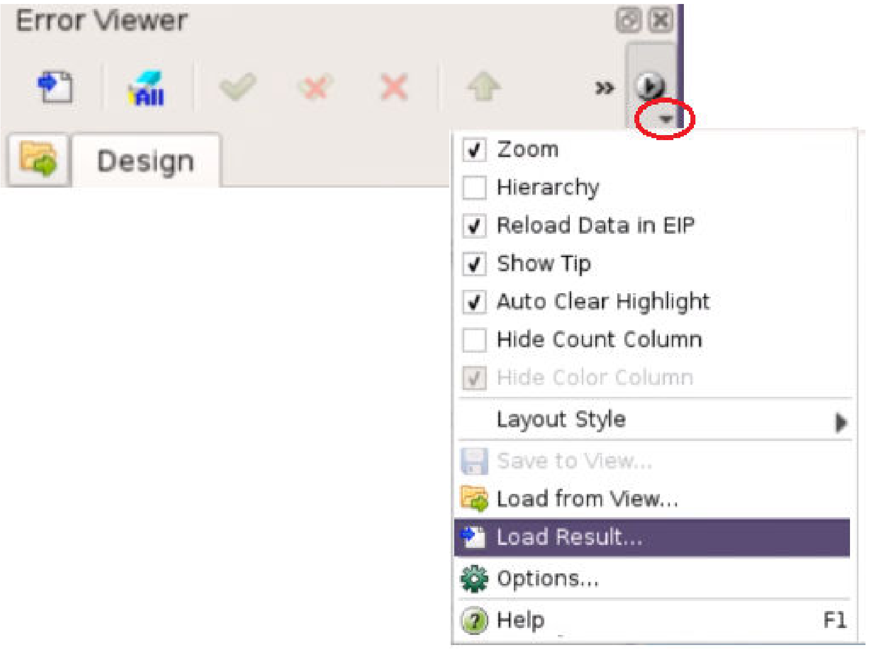
   The Error Viewer window appears (Figure 27).

Figure 27 Error Viewer Window



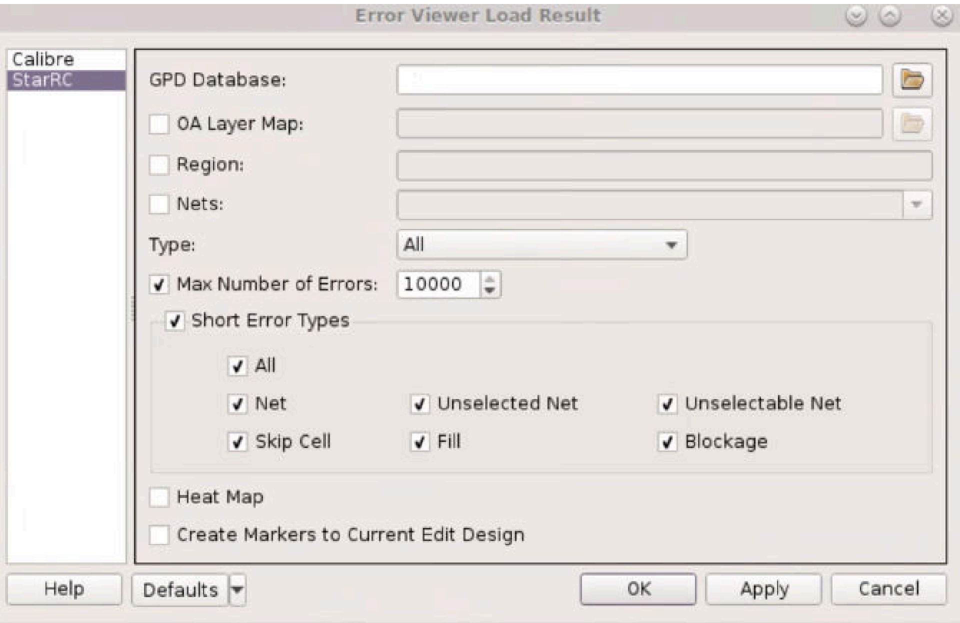
3. Click drop-down key **> Load Result...** (Figure 28).

Figure 28 Error View Load Result Menu



The Error Viewer Load Result window appears (Figure 29).

Figure 29 Error Viewer Load Result Window



GPD Database:

□ OA Layer Map:

□ Region:

□ Nets:

Type: All

☑ Max Number of Errors: 10000

☑ Short Error Types

☑ All

☑ Net ☑ Unselected Net ☑ Unselectable Net

☑ Skip Cell ☑ Fill ☑ Blockage

□ Heat Map

□ Create Markers to Current Edit Design

4. In the Error Viewer Load Result window (Figure 29),

   a. Select StarRC.

   b. Select a GPD directory from your local folder in the **GPD Database** box.

   c. Select **Short Error Types**.

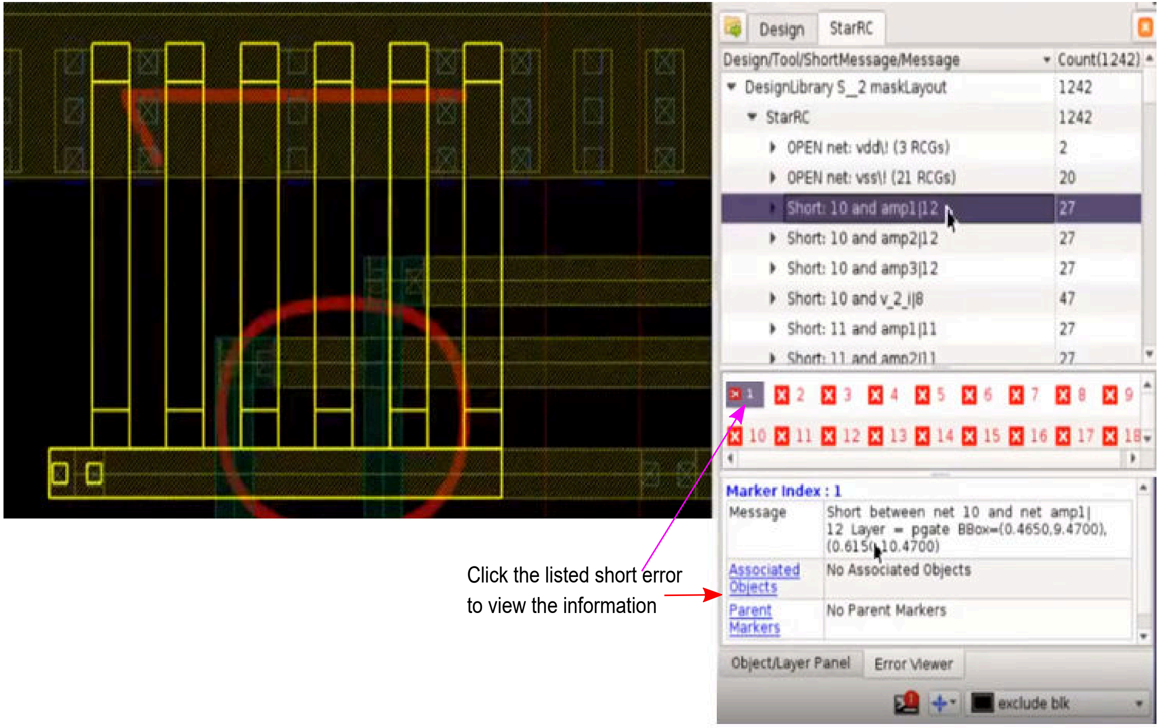
   d. Click **Apply** and **OK**.

   The Layout Editor window displays all open and short errors.

5. Select a short error from the list to list and display all shorts for a specific net (Figure 30).

   You can expand or highlight to analyze and debug the open and short errors in the Layout Editor window.

Figure 30   Display Information for the Selected Short Error



Design/Tool/ShortMessage/Message	Count(1242)
DesignLibrary S_2 maskLayout	1242
StarRC	1242
OPEN net: vdd\! (3 RCGs)	2
OPEN net: vss\! (21 RCGs)	20
Short: 10 and amp1|12	27
Short: 10 and amp2|12	27
Short: 10 and amp3|12	27
Short: 10 and v_2_i|8	47
Short: 11 and amp1|11	27
Short: 11 and amp2|11	27

Marker Index : 1

Message	Short between net 10 and net amp1|12 Layer = pgate BBox=(0.4650,9.4700),(0.6150,10.4700)
Associated Objects	No Associated Objects
Parent Markers	No Parent Markers

Click the listed short error to view the information

Using Parasitic Explorer From the Virtuoso Tool

The Virtuoso Integration (VI) interface with the Cadence® Virtuoso® custom design platform allows to perform the following Parasitic Explorer tasks:

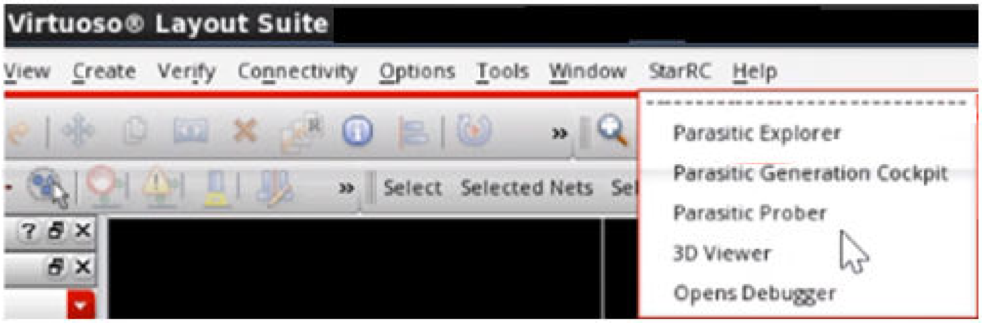
- Highlight resistors, capacitors in an OA view
- Analyze GUI based parasitics and errors

For detailed information on how to use the Virtuoso Integration (VI) interface, see the *StarRC User Guide and Command Reference* on SolvNetPlus.

To launch the Parasitic Explorer GUI from the Virtuoso menu bar and to use the Parasitic Explorer commands,

1. Start the GUI from the StarRC OA View.
2. Choose **StarRC > Parasitic Explorer** from the Virtuosos menu bar (Figure 31).

Figure 31 Starting Parasitic Explorer in Virtuoso



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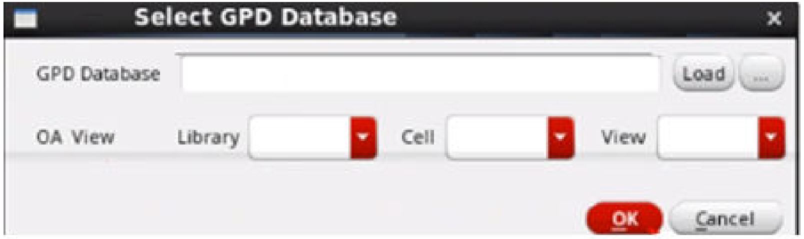
The StarRC shell is launched in the background. The Select GPD Database window appears (Figure 32).

Figure 32 Selecting a GPD Database



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3. In the Select GPD Database window,

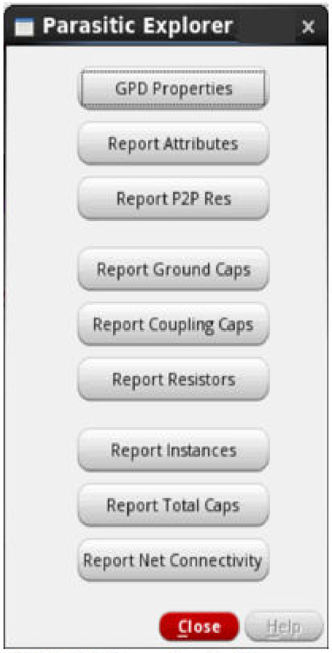
   a. Select a GPD directory from your local folder in the **GPD Database** box and click **Load**.

   b. Select **OA View** for annotation.

   c. Click **OK**.

   The Parasitic Explorer window appears (Figure 33).

Figure 33 Parasitic Explorer Window



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4. Click **Close** when you are done examining the nets to close the Parasitic Explorer GUI.

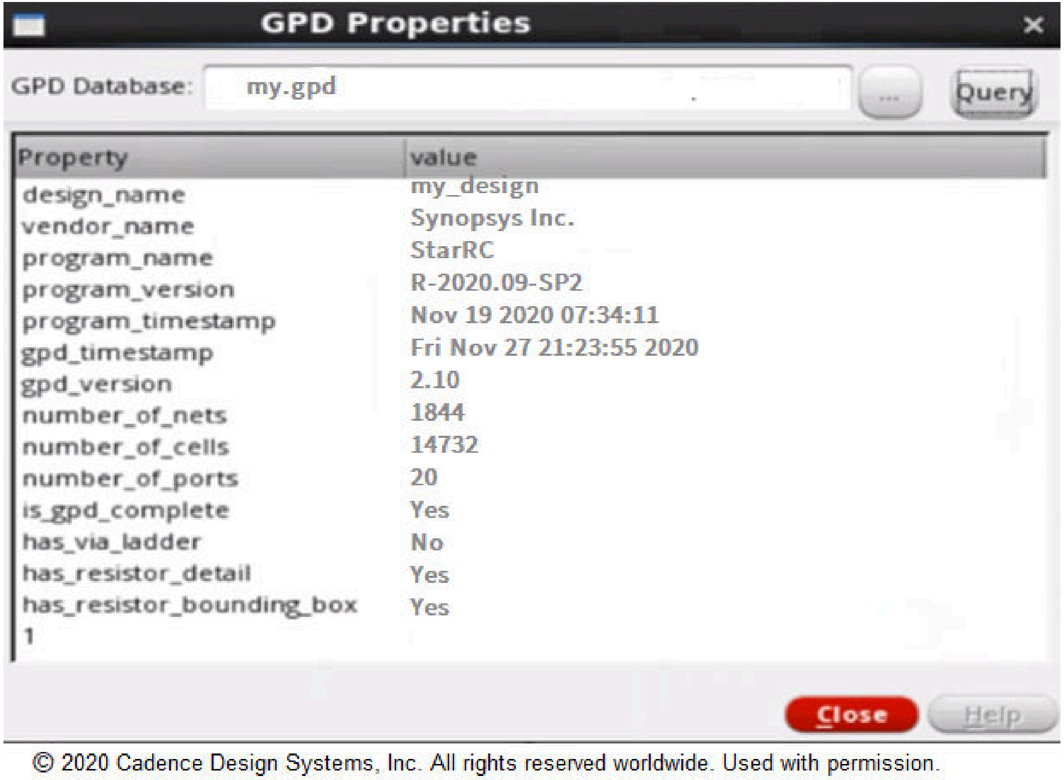
In the Parasitic Explorer window (Figure 33), you can perform any of the following tasks:

Note:

Perform only one task at a time.

- Click **GPD Properties** and specify a GPD directory in the **GPD Database** box, and click **Query** to view the contents of the uploaded GPD directory (Figure 34).

Figure 34 GPD Properties Window



GPD Database: my.gpd

Property	value
design_name	my_design
vendor_name	Synopsys Inc.
program_name	StarRC
program_version	R-2020.09-SP2
program_timestamp	Nov 19 2020 07:34:11
gpd_timestamp	Fri Nov 27 21:23:55 2020
gpd_version	2.10
number_of_nets	1844
number_of_cells	14732
number_of_ports	20
is_gpd_complete	Yes
has_via_ladder	No
has_resistor_detail	Yes
has_resistor_bounding_box	Yes
1	

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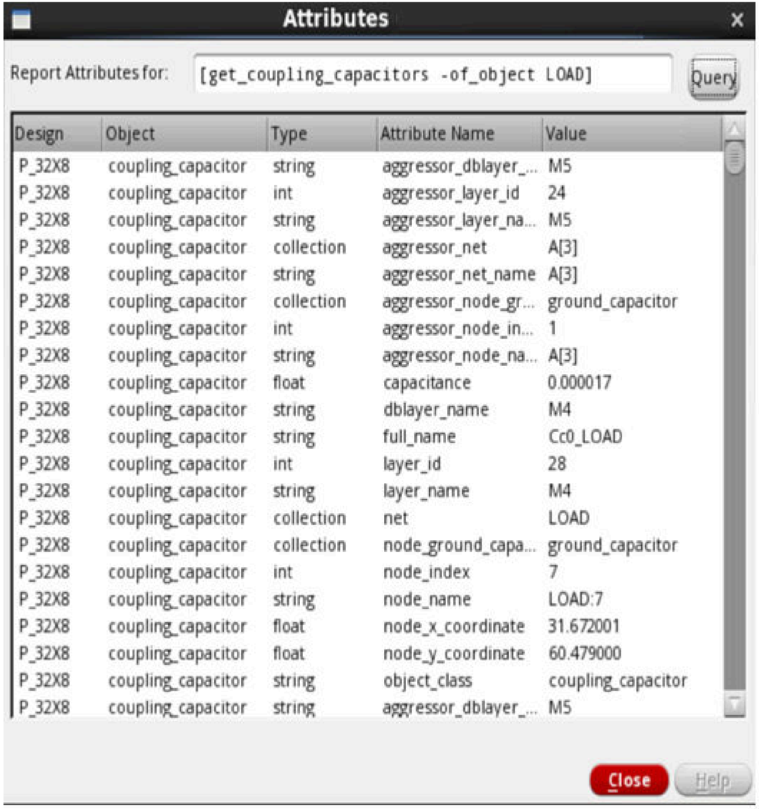
- Click **Report Attributes** and specify a Tcl command in the **Report Attributes for** box, and click **Query** to display the report (Figure 35).

Figure 35 Reporting Attributes



Report Attributes for: [get_coupling_capacitors -of_object LOAD]

Design	Object	Type	Attribute Name	Value
P_32X8	coupling_capacitor	string	aggressor_dblayer_...	M5
P_32X8	coupling_capacitor	int	aggressor_layer_id	24
P_32X8	coupling_capacitor	string	aggressor_layer_na...	M5
P_32X8	coupling_capacitor	collection	aggressor_net	A[3]
P_32X8	coupling_capacitor	string	aggressor_net_name	A[3]
P_32X8	coupling_capacitor	collection	aggressor_node_gr...	ground_capacitor
P_32X8	coupling_capacitor	int	aggressor_node_in...	1
P_32X8	coupling_capacitor	string	aggressor_node_na...	A[3]
P_32X8	coupling_capacitor	float	capacitance	0.000017
P_32X8	coupling_capacitor	string	dblayer_name	M4
P_32X8	coupling_capacitor	string	full_name	Cc0_LOAD
P_32X8	coupling_capacitor	int	layer_id	28
P_32X8	coupling_capacitor	string	layer_name	M4
P_32X8	coupling_capacitor	collection	net	LOAD
P_32X8	coupling_capacitor	collection	node_ground_capa...	ground_capacitor
P_32X8	coupling_capacitor	int	node_index	7
P_32X8	coupling_capacitor	string	node_name	LOAD:7
P_32X8	coupling_capacitor	float	node_x_coordinate	31.672001
P_32X8	coupling_capacitor	float	node_y_coordinate	60.479000
P_32X8	coupling_capacitor	string	object_class	coupling_capacitor
P_32X8	coupling_capacitor	string	aggressor_dblayer_...	M5

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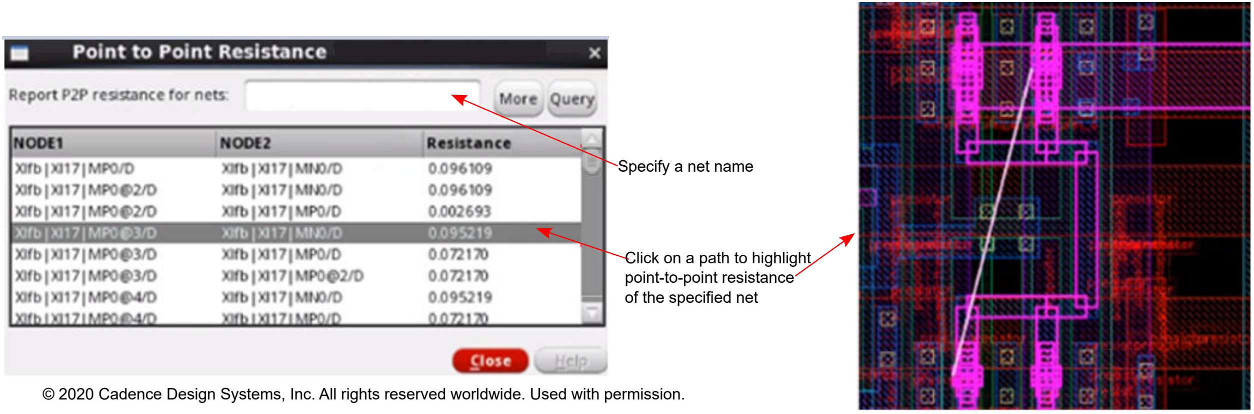
- Click **Report P2P Res** and specify a net name in the **Report P2P resistance for nets** box, and click **Query** to report point-to-point resistance of the specified net and highlight a path (Figure 36).

Figure 36 Reporting Point-to-Point Resistance



Report P2P resistance for nets:

NODE1	NODE2	Resistance
XIfb|XI17|MP0/D	XIfb|XI17|MN0/D	0.096109
XIfb|XI17|MP0@2/D	XIfb|XI17|MN0/D	0.096109
XIfb|XI17|MP0@2/D	XIfb|XI17|MP0/D	0.002693
XIfb|XI17|MP0@3/D	XIfb|XI17|MN0/D	0.095219
XIfb|XI17|MP0@3/D	XIfb|XI17|MP0/D	0.072170
XIfb|XI17|MP0@3/D	XIfb|XI17|MP0@2/D	0.072170
XIfb|XI17|MP0@4/D	XIfb|XI17|MN0/D	0.095219
XIfb|XI17|MP0@4/D	XIfb|XI17|MP0/D	0.072170

Specify a net name

Click on a path to highlight point-to-point resistance of the specified net

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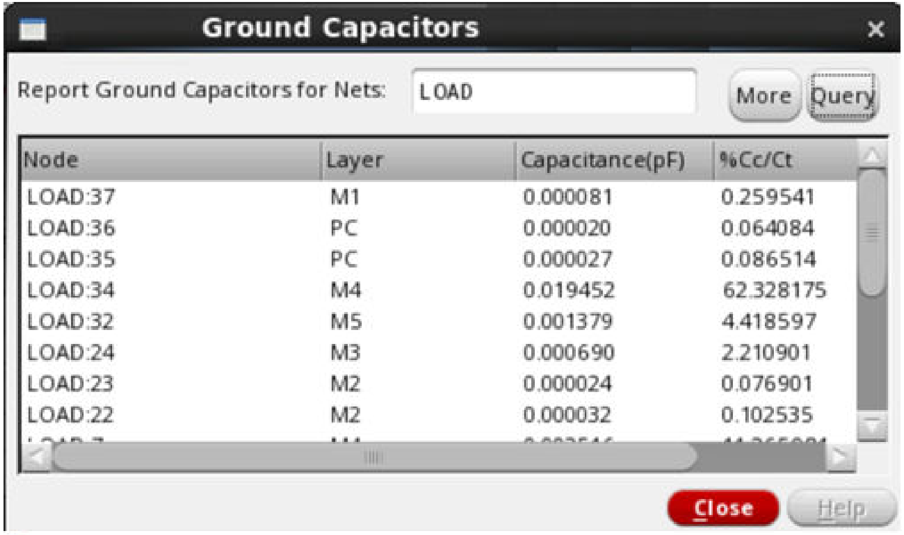
- Click **Report Ground Caps** and specify a net name in the **Report Ground Capacitors for Nets** box, and click **Query** to report ground capacitance of the specified net (Figure 37).

Figure 37 Reporting Ground Capacitance



Report Ground Capacitors for Nets: LOAD

Node	Layer	Capacitance(pF)	%Cc/Ct
LOAD:37	M1	0.000081	0.259541
LOAD:36	PC	0.000020	0.064084
LOAD:35	PC	0.000027	0.086514
LOAD:34	M4	0.019452	62.328175
LOAD:32	M5	0.001379	4.418597
LOAD:24	M3	0.000690	2.210901
LOAD:23	M2	0.000024	0.076901
LOAD:22	M2	0.000032	0.102535

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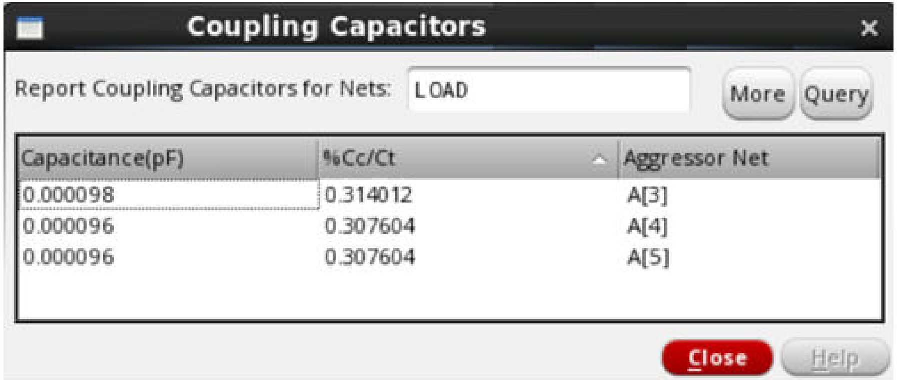
- Click **Report Coupling Caps** and specify a net name in the **Report Coupling Capacitors for Nets** box, and click **Query** to report coupling capacitance of the specified net (Figure 38).

Figure 38 Reporting Coupling Capacitance



Report Coupling Capacitors for Nets: LOAD

Capacitance(pF)	%Cc/Ct	Aggressor Net
0.000098	0.314012	A[3]
0.000096	0.307604	A[4]
0.000096	0.307604	A[5]

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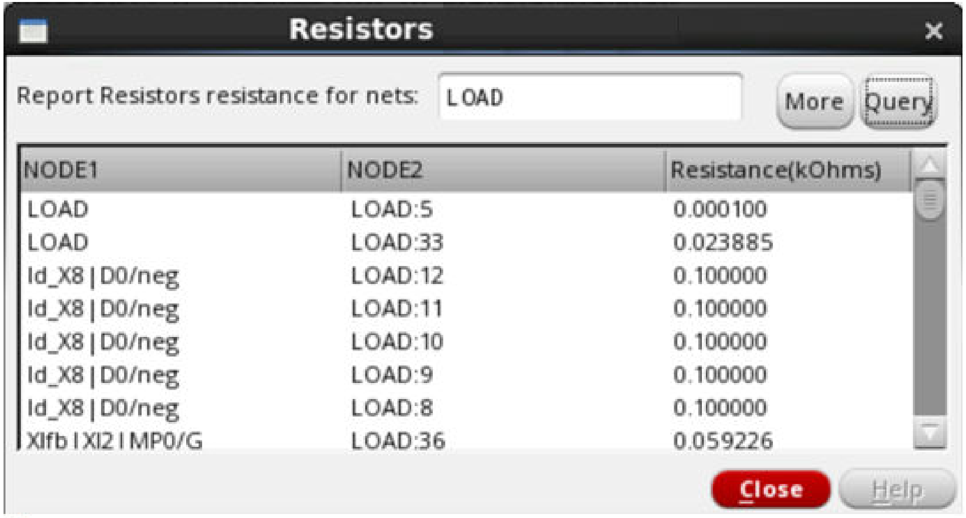
- Click **Report Resistors** and specify a net name in the **Report Resistors resistance for Nets** box, and click **Query** to report resistance of the specified net (Figure 39).

Figure 39   Reporting Resistance



Report Resistors resistance for nets: LOAD

NODE1	NODE2	Resistance(kOhms)
LOAD	LOAD:5	0.000100
LOAD	LOAD:33	0.023885
Id_X8|D0/neg	LOAD:12	0.100000
Id_X8|D0/neg	LOAD:11	0.100000
Id_X8|D0/neg	LOAD:10	0.100000
Id_X8|D0/neg	LOAD:9	0.100000
Id_X8|D0/neg	LOAD:8	0.100000
XIfb|XI2|MP0/G	LOAD:36	0.059226

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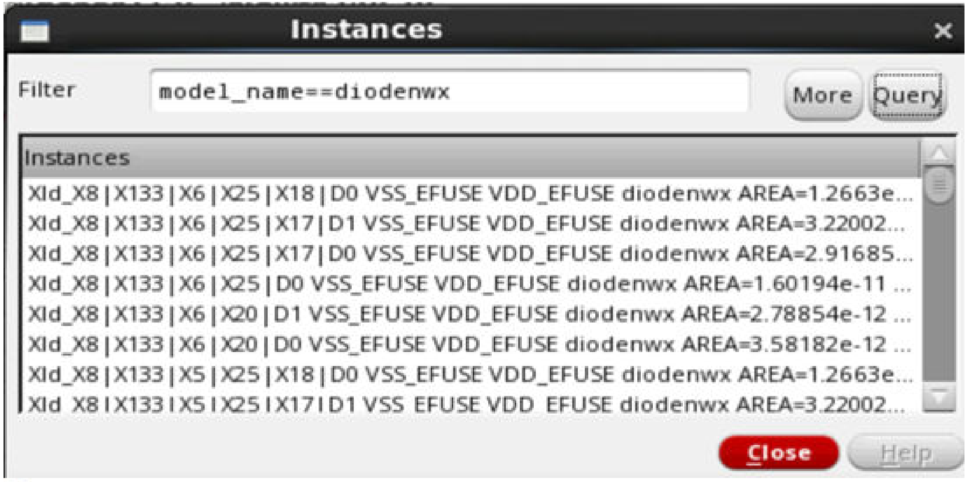
- Click **Report Instances** and specify a cell name in the **Filter** box, and click **Query** (Figure 40).

Figure 40   Reporting Instances



Filter: model_name==diodenwx

Instances
XId_X8|X133|X6|X25|X18|D0 VSS_EFUSE VDD_EFUSE diodenwx AREA=1.2663e...
XId_X8|X133|X6|X25|X17|D1 VSS_EFUSE VDD_EFUSE diodenwx AREA=3.22002...
XId_X8|X133|X6|X25|X17|D0 VSS_EFUSE VDD_EFUSE diodenwx AREA=2.91685...
XId_X8|X133|X6|X25|D0 VSS_EFUSE VDD_EFUSE diodenwx AREA=1.60194e-11 ...
XId_X8|X133|X6|X20|D1 VSS_EFUSE VDD_EFUSE diodenwx AREA=2.78854e-12 ...
XId_X8|X133|X6|X20|D0 VSS_EFUSE VDD_EFUSE diodenwx AREA=3.58182e-12 ...
XId_X8|X133|X5|X25|X18|D0 VSS_EFUSE VDD_EFUSE diodenwx AREA=1.2663e...
XId_X8|X133|X5|X25|X17|D1 VSS_EFUSE VDD_EFUSE diodenwx AREA=3.22002...

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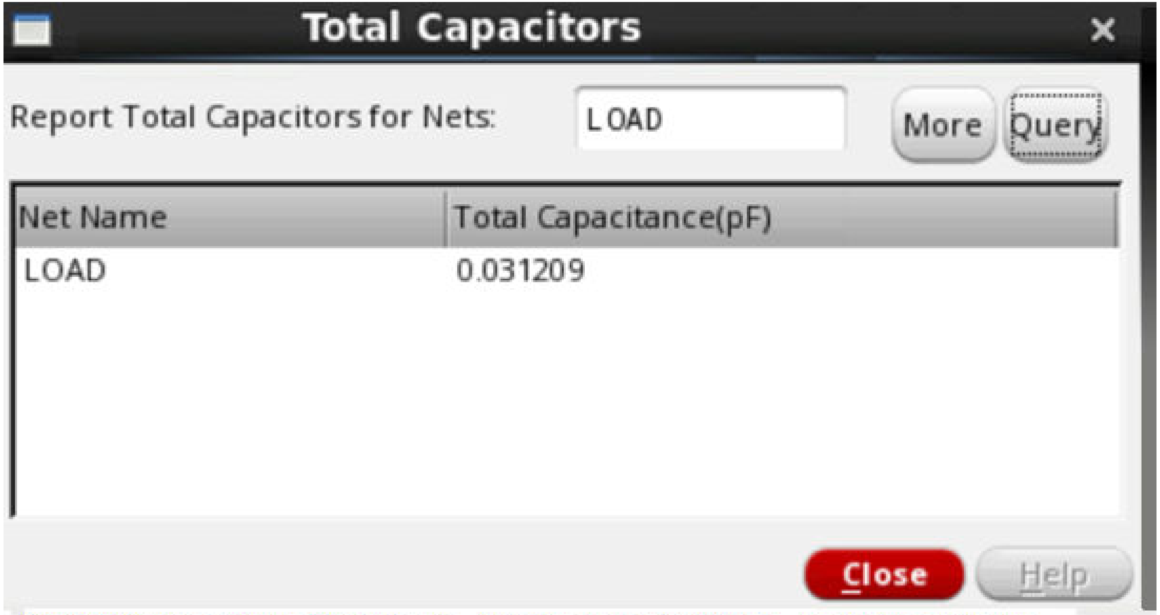
- Click **Report Total Caps** and specify a net name in the **Report Total Capacitors for Nets** box, and click **Query** to report total capacitance of the specified net (Figure 41).

Figure 41 Reporting Total Capacitance



Report Total Capacitors for Nets: LOAD

Net Name	Total Capacitance(pF)
LOAD	0.031209

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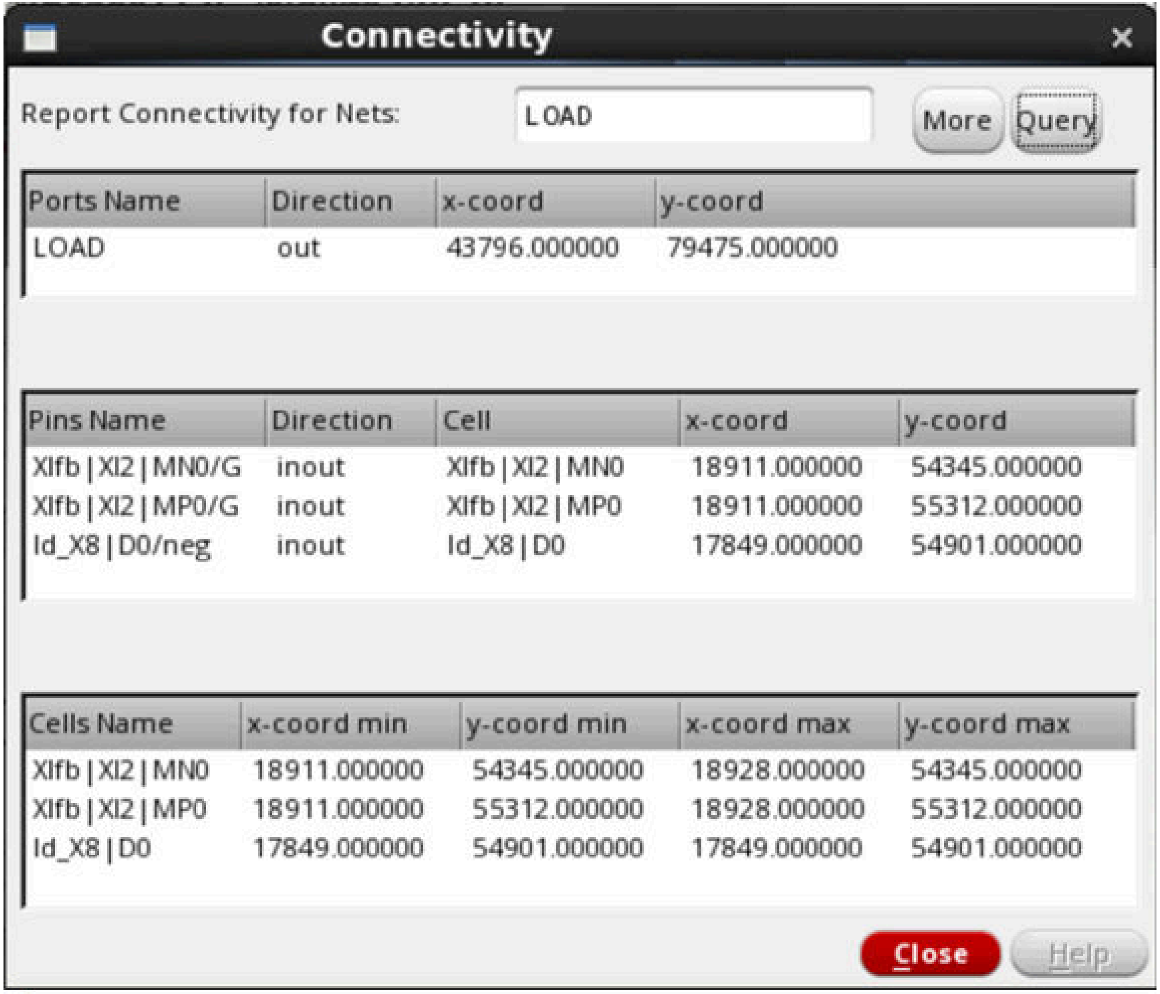
- Click **Net Connectivity** and specify a net name in the **Report Connectivity for Nets** box, and click **Query** to report names of ports, pins, and cells of the specified net with their direction and x and y-coordinates (Figure 42).

Figure 42 Connectivity Report of the Specified Net



Report Connectivity for Nets: LOAD

Ports Name	Direction	x-coord	y-coord
LOAD	out	43796.000000	79475.000000

Pins Name	Direction	Cell	x-coord	y-coord
XIfb|XI2|MN0/G	inout	XIfb|XI2|MN0	18911.000000	54345.000000
XIfb|XI2|MP0/G	inout	XIfb|XI2|MP0	18911.000000	55312.000000
Id_X8|D0/neg	inout	Id_X8|D0	17849.000000	54901.000000

Cells Name	x-coord min	y-coord min	x-coord max	y-coord max
XIfb|XI2|MN0	18911.000000	54345.000000	18928.000000	54345.000000
XIfb|XI2|MP0	18911.000000	55312.000000	18928.000000	55312.000000
Id_X8|D0	17849.000000	54901.000000	17849.000000	54901.000000

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Using Tcl Commands in StarRC Shell

You can generate a report for parasitic resistors, ground capacitors, point-to-point resistance, RC contributions, and so on for specific nets using Tcl commands.

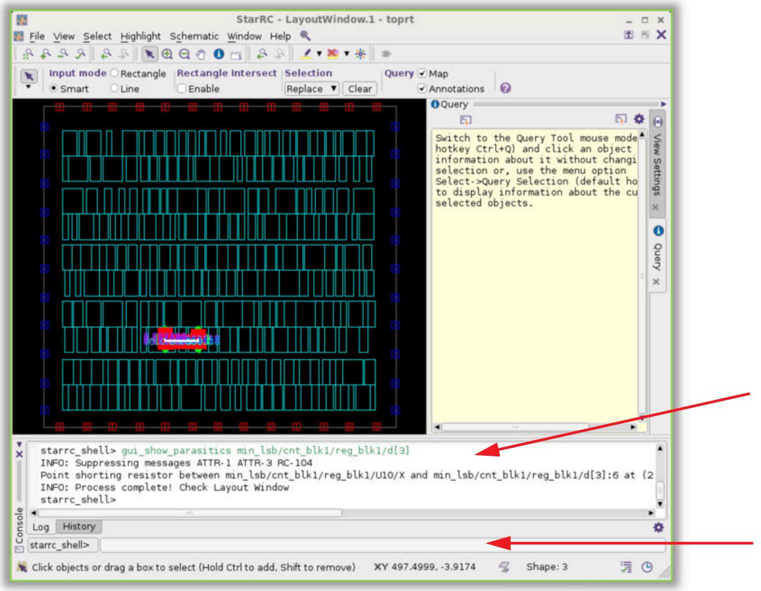
- `get*` commands such as `get_coupling_capacitors`, `get_ground_capacitors`, and `get_resistors`.
- `report*` commands such as `report_resistors`, `report_ground_capacitors`, `report_point_to_point_resistance`, and `report_rc_components`.

For more information about specific Parasitic Explorer Tcl commands, see Chapter 4, Parasitic Explorer Command Reference.

To run Tcl commands in the StarRC shell,

1. Set up the gate-level flow (see Setting Up the Gate-Level Flow and Figure 3)..

Figure 43 GUI Console to Execute Commands



```
Switch to the Query Tool mouse mode
hotkey Ctrl+Q) and click an object
information about it without changi
selection or, use the menu option
Select->Query Selection (default ho
to display information about the cu
selected objects.
```

```
starrc_shell> gui_show_parasitics min_lsb/cnt_blk1/reg_blk1/d[3]
INFO: Suppressing messages ATTR-1 ATTR-3 RC-104
Point shorting resistor between min_lsb/cnt_blk1/reg_blk1/U10/X and min_lsb/cnt_blk1/reg_blk1/d[3]:6 at (2
INFO: Process complete! Check Layout Window
starrc_shell>
```

```
starrc_shell>
```

Shell commands displayed after execution

Command line

2. Create a collection of all open nets by using the `starrc_open` net attribute:

```
starrc_shell> get_nets -filter "starrc_open==true"
{"min_lsb/cnt_blk1/n184",
"min_lsb/cnt_blk1/n191",
"min_lsb/cnt_blk1/n195"}
```

3. Create a collection of all shorted nets by using the `starrc_short` net attribute:

```
starrc_shell> get_nets -filter "starrc_short==true"
{"sec_lsb/cnt_blk1/n157",
"sec_lsb/conv_blk1/n16"}
```

4. Report a collection object of shorts or opens. Each object is associated with an error class, which is either `open_locator` or `short`, and the object class `drc_error`.

```
starrc_shell> report_attribute -application \
           [get_drc_errors -error_data starrc_openshort.err] -nosplit

******************************
Report: Attribute
Design: toprt
Version: P-2019.03
Date: Mon Feb 11 18:23:34 2019
******************************

Design   Object    Type          Attribute       Value
----------------------------------------------------------------------
toprt       0      string        bbox            {255.600 110.000 ...
toprt       0      collection    bounding_box    {255.600 110.000 ...
toprt       0      string        brief_info      open on net min_lsb
toprt       0      string        endpoints       {{255.600 129.200 ...
toprt       0      string        error_class     open_locator
toprt       0      collection    error_data      starrc_openshort.err
...
toprt       0      string        object_class    drc_error
...
```

5. Report a collection of error types. Each object is associated with an error class, which is either `open_locator` or `short`, and the object class `drc_error_type`.

```
starrc_shell> report_attribute -application \
           [get_drc_error_types -error_data starrc_openshort.err]

******************************
Report: Attribute
Design: toprt
Version: P-2019.03
Date: Mon Feb 11 19:03:12 2019
******************************

Design   Object        Type        Attribute      Value
----------------------------------------------------------------------
toprt  lsb/blk1/n184   string      bbox           {255.600 110.000 ...
toprt  lsb/blk1/n184   collection  bounding_box   {255.600 110.000 ...
toprt  lsb/blk1/n184   string      brief_format   message
toprt  lsb/blk1/n184   string      brief_info     open on net min_lsb
toprt  lsb/blk1/n184   string      error_class    open_locator
toprt  lsb/blk1/n184   collection  error_data     starrc_openshort.err
```

```
...
toprt  lsb/blk1/n184   string      object_class   drc_error_type
...
```

6. Exit the StarRC shell session with the `quit` or `exit` command.

```
starrc_shell> quit
```

3

Working With the Parasitic Database

The Parasitic Explorer tool provides commands to examine properties of the GPD itself.

For information about GPD commands, see the following topics:

- Querying GPD Data Stored on Disk
- Reporting GPD Properties
- Setting GPD Annotation Properties
- Getting GPD Corners and Layers

Querying GPD Data Stored on Disk

The Parasitic Explorer tool provides commands to examine the properties of the GPD itself. The following commands are available:

- `report_gpd_properties` – Reports the properties of the parasitic data such as completeness, the presence or absence of specific types of data, and the number of nets, cells, and ports
- `set_gpd_config` – Specifies the parasitic corners to be read and the thresholds for filtering coupling capacitors during reading
- `report_gpd_config` – Reports the option settings for reading the GPD data
- `reset_gpd_config` – Resets the settings made by the `set_gpd_config` command
- `get_gpd_corners` – Reports the parasitic corner names defined in the GPD directory
- `get_gpd_layers` – Reports the layer names defined in the GPD directory

Reporting GPD Properties

The `report_gpd_properties` command reports general information about the data in a specified GPD directory. For example:

```
starrc_shell> report_gpd_properties -gpd MyDesignA.gpd
 ...
GPD Summary:
Properties                        Value
------------------------------------------------------------
design_name                       MyDesignA
vendor_name                       Synopsys Inc.
program_name                      StarRC
program_version                   O-2018.06-SP4
program_timestamp                 July  1 2018 21:02:19
gpd_timestamp                     Tue Apr 10 18:26:45 2018
gpd_version                       2.6
number_of_nets                    288930
number_of_cells                   234730
...
```

The `-layers` option lists the layers present in the GPD for the specified design. For example:

```
starrc_shell> report_gpd_properties -layers -gpd MyDesignA.gpd
 ...
Layer information:
Name                Properties              Value
-------------------------------------------------------
```

```
SUBSTRATE           id                      0
SUBSTRATE           is_via                  No
poly                id                      1
poly                is_via                  No
M1                  id                      2
M1                  is_via                  No
...
```

The -parasitic_corners option lists the corners present in the GPD for the specified design. For example:

```
starrc_shell> report_gpd_properties -parasitic_corners -gpd MyDesignA.gpd
 ...
Corner information:
Name                Properties              Value
------------------------------------------------------------------
CMINW125            process_name            /mydata/mypara/grd.min
CMINW125            temperature             125
CMINW125            global_temperature      25
CMINB40             process_name            /mydata/mypara/grd.min
CMINB40             temperature             -40
CMINB40             global_temperature      25
...
```

Setting GPD Annotation Properties

The set_gpd_config command lets you override parameters for reading parasitic data from a GPD with the read_parasitics -format gpd command.

The default parameters are defined in a file called the GPD configuration file, which always exists in a GPD. You can write an ASCII version of the configuration file by using the StarXtract -dump_gpd_config command in the StarRC tool.

For example, the following command sets both absolute and relative thresholds for filtering coupling capacitors:

```
starrc_shell> set_gpd_config -gpd my_design1.gpd \
 -absolute_coupling_threshold 3.0e-3 \
 -relative_coupling_threshold 0.03
```

To report the GPD configuration that has been set, use the report_gpd_config command:

```
starrc_shell> report_gpd_config -gpd my_design.gpd
 ...

Property                         Value
--------------------------------------------------------
absolute_coupling_threshold      0.003000
relative_coupling_threshold      0.030000
```

```
coupling_threshold_operation     and
netlist_select_nets              *
netlist_type                     {RCC *}
selected_parasitic_corners       TYP25 CWORST110 CBEST0
...
```

To include reporting of options that were set in the StarRC tool during parasitic extraction, use the `-include_starrc_options` option:

```
starrc_shell> report_gpd_config -gpd my_design.gpd
 -include_starrc_options
 ...
Property                         Value                     StarRC
-------------------------------------------------------------------------
absolute_coupling_threshold      0.003000                  N
relative_coupling_threshold      0.030000                  N
coupling_threshold_operation     and                       N
netlist_select_nets              *                         N
netlist_type                     {RCC *}                   N
selected_parasitic_corners       TYP25 CWORST110 CBEST0    N
netlist_compress                 true                      Y
dp_string                        true                      Y
netlist_connect_section          false                     Y
pin_delimiter                    /                         Y
netlist_name_map                 true                      Y
netlist_incremental              false                     Y
```

To reset options previously set by the `set_gpd_config` command, use the `reset_gpd_config` command:

```
starrc_shell> reset_gpd_config -gpd my_design.gpd
```

Getting GPD Corners and Layers

To report the parasitic corners or layers that are present in a GPD directory, use the `get_gpd_corners` or `get_gpd_layers` command:

```
starrc_shell> get_gpd_corners -gpd my_design1.gpd
CWORST110 TYP25 CBEST0
starrc_shell> get_gpd_layers -gpd my_design1.gpd
M1 M2 M3 M4 VIA1 VIA2 VIA3
```

4

Parasitic Explorer Command Reference

This section provides reference information for Parasitic Explorer commands and variables.

For more information, see the following topics:

- report_resistors
- report_total_net_capacitance
- report_rc_components
- report_rc_corner_ratios
- report_routed_nets
- scale_parasitics
- set_layout_database_options
- starrc_gpd_read_opens_shorts
- start_gui
- write_parasitics
- Other Supported Commands

check_layout_database

Reads the physical library and design files and checks the data for correctness and consistency.

Syntax

```
check_layout_database
```

check_parasitics_consistency

The StarRC tool provides a parasitic netlist checker that operates on an SPF file to verify the output of a netlist in a transistor-level flow.

To verify the output of the parasitic netlist, use the `check_parasitics_consistency` command.

For detailed information to use the command, see the *StarRC User Guide and Command Reference*.

Feedback

get_coupling_capacitors

Creates a collection of the coupling capacitors associated with one or more nets.

Syntax

```
get_coupling_capacitors
     [-filter expression]
     [-quiet]
     [-parasitic_corners corner_names]
     [-all_parasitic_corners]
     -of_objects nets | -from node1 -to node2
```

Arguments

Option and Argument	Data Type	Description
`-filter_expression`	none	Refines the list of coupling capacitors by using arithmetic or relational operators with the attributes of the coupling capacitor objects.
`-quiet`	none	Suppresses warning and error messages if the command does not retrieve any objects
`-parasitic_corners` *`corner_names`*	list	Specifies the corners in the GPD to query. If this option is omitted, the corner specified by the `parasitic_corner_name` variable is selected.
`-all_parasitic_corners`	none	Queries all corners in the GPD
`-of_objects` *`nets`*	list	Specifies the nets for which to return the coupling capacitors.
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-from` option.

Description

You can specify a node by a pin name, a port name, or a node index. To specify a node index, use the format `net_name:node_ID`. For a given net, valid node IDs are from 1 to N inclusive, where N is the number of net nodes. Note that in the GPD and in SPEF files generated from a GPD, node numbering begins at 0 and ends at N-1.

You must use either the -of_objects option or both the -from and -to options.

Examples

The following command finds the coupling capacitors attached to net abc:

```
starrc_shell> get_coupling_capacitors -of_objects abc
_sel15
```

The following command finds the coupling capacitors attached to all nets whose names begin with ABC and returns only those capacitors whose aggressor node name is XYZ:1.

```
starrc_shell> get_coupling_capacitors -of_objects ABC* \
              -filter "aggressor_node_name == XYZ:1"
_sel16
```

After the command executes, the collection handle is displayed. In the examples, _sel15 and _sell 6 are collection handles. The collection handle is an automatically-generated name for the collection of objects created by the command. If you want to use the objects in additional operations, you must set the collection to a variable or nest it within another command.

The following command saves the coupling capacitors of net abc into a variable named abc_cc:

```
starrc_shell> set abc_cc get_coupling_capacitors -of_objects abc
```

Use commands such as the foreach_in_collection command to loop through the objects in a collection. For more information about working with collections, see *Using Tcl With Synopsys Tools*.

Attributes of Coupling Capacitors

Object properties are stored in attributes. Table 3 lists the attributes available for coupling capacitors, which have the object class coupling_capacitor. For coupling capacitors, the victim net is the net specified in the get_coupling_capacitors command. The aggressor net is the net to which the victim net is coupled by the returned parasitic capacitor.

Table 3 Coupling Capacitor Attributes

Name	Format	Definition
aggressor_layer_id	integer	The layer ID of the ITF file (nxtgrd file) for the aggressor net
aggressor_layer_name	string	The layer name of the ITF file (nxtgrd file) for the aggressor net
aggressor_net	collection	The aggressor net associated with the coupling capacitor

Table 3 Coupling Capacitor Attributes (Continued)

Name	Format	Definition
aggressor_net_name	string	The aggressor net name, in SPEF file format
aggressor_node_ ground_ capacitor	collection	The ground capacitor associated with the aggressor node of the coupling capacitor
aggressor node_index	integer	The index value of the node where the coupling capacitor connects to the aggressor net. Every node on a net has a unique index from 1 to N, where N is the total number of nodes on that net.
aggressor_node_name	string	The aggressor node name, in SPEF file format
capacitance	float	The single-corner capacitance value in the format used in a SPEF output file. The capacitance units are pF (different from capacitances reported in a SPEF netlist, which have units of fF).
capacitance_max	float	The maximum value of the list in the `capacitance_multicorner` attribute
capacitance_min	float	The minimum value of the list in the `capacitance_multicorner` attribute
capacitance_ multicorner	string	A list of the capacitances of all corners specified by the `-parasitic_corners` option, in the same order. If the `-all_parasitic_corners` option is used, the order of the corners is the same as the order in the GPD, which is controlled by the `SELECTED_CORNERS` command in the StarRC command file used for extraction.
layer_id	integer	The layer ID in the nxtgrd file for the victim net
layer_name	string	The layer name in the nxtgrd file for the victim net
net	collection	The victim net associated with the coupling capacitor
node_ground_ capacitor	collection	The ground capacitor associated with the victim node of the coupling capacitor
node_index	integer	The index value of the node where the coupling capacitor connects to the victim net
node_name	string	The victim node name, in SPEF file format
object_class	string	The value is `coupling_capacitor`

get_elmore_delay

Calculates the effective Elmore delay between two nodes.

Syntax

```
get_elmore_delay
     [-quiet corner_names]
     [-parasitic_corners corner_names]
     [-all_parasitic_corners]
     [-from node1]
     [-to node2]
```

Arguments

Option and Argument	Data Type	Description
`-quiet`	none	Suppresses warning and error messages if the command does not retrieve any objects
`-parasitic_corners` *`corner_names`*	list	Specifies the corners in the GPD to query. If this option is omitted, the corner specified by the `parasitic_corner_name` variable is selected.
`-all_parasitic_corners`	none	Queries all corners in the GPD
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-from` option.

Description

You can specify a node by a pin name, a port name, or a node index. To specify a node index, use the `net_name:node_ID` format. For a given net, valid node IDs are from 1 to N inclusive, where N is the number of net nodes. Note that in the GPD and in SPEF files generated from a GPD, node numbering begins at 0 and ends at N-1.

Examples

The following example calculates the Elmore delay from the my_port port to the sec/blk1/U41/my_pin pin of the my_port net for all parasitic corners:

```
starrc_shell> get_elmore_delay -from my_port -to sec/blk1/U41/my_pin
 -all_parasitic_corners
[46.2063,47.808,44.0004]
```

The following example calculates the Elmore delay from the my_port port to the sec/blk1/U41/my_pin pin of the my_port net for the typ parasitic corner:

```
starrc_shell> get_elmore_delay -from my_port -to sec/blk1/U41/my_pin
 -parasitic_corners typ
46.2063
```

get_ground_capacitors

Creates a collection of the ground capacitors for one or more nets.

Syntax

```
get_ground_capacitors
     [-filter expression]
     [-quiet]
     [-parasitic_corners corner_names]
     [-all_parasitic_corners]
     -of_objects nets | -from node1 -to node2
```

Arguments

Option and Argument	Data Type	Description
`-filter_expression`	none	Refines the list of ground capacitors by using arithmetic or relational operators with the attributes of the ground capacitor objects.
`-quiet`	none	Suppresses warning and error messages if the command does not retrieve any objects.
`-parasitic_corners` *`corner_names`*	list	Specifies the corners in the GPD to query. If this option is omitted, the corner specified by the `parasitic_corner_name` variable is selected.
`-all_parasitic_corners`	none	Queries all corners that are present in the GPD.
`-of_objects` *`nets`*	list	Specifies the nets for which to retrieve the ground capacitors.
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool returns the ground capacitors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool returns the ground capacitors between this node and the node specified in the `-from` option.

Description

You can specify a node by a pin name, a port name, or a node index. To specify a node index, use the format `net_name:node_ID`. For a given net, valid node IDs are from 1 to N inclusive, where N is the number of net nodes. Note that in the GPD and in SPEF files generated from a GPD, node numbering begins at 0 and ends at N-1.

You must use either the `-of_objects` option or both the `-from` and `-to` options.

Attributes of Ground Capacitors

Object properties are stored in attributes. Table 4 lists the attributes available for ground capacitors, which have the object class `ground_capacitor`.

Table 4 Ground Capacitor Attributes

Name	Format	Definition
capacitance	float	The single-corner capacitance value, in SPEF file format. The capacitance units are pF (different from capacitances reported in a SPEF netlist, which have units of fF).
capacitance_max	float	The maximum value of the list in the `capacitance_multicorner` attribute
capacitance_min	float	The minimum value of the list in the `capacitance_multicorner` attribute
capacitance_ multicorner	string	A list of the capacitances of all corners specified by the `-parasitic_corners` option, in the same order. If the `-all_parasitic_corners` option is used, the order of the corners is the same as the order in the GPD, which is controlled by the `SELECTED_CORNERS` command in the StarRC command file used for extraction.
layer_id	integer	The layer ID in the nxtgrd file
layer_name	string	The layer name in the nxtgrd file
net	collection	The net that contains the ground capacitor
node_index	integer	The index value of the node at which the ground capacitor connects to the net. Every node on a net has a unique index from 1 to N, where N is the total number of nodes on that net.
node_name	string	The node name, in SPEF file format
node_type	string	The node type (`pin`, `port`, or `internal node`)
object_class	string	The value is `ground_capacitor`
x_coordinate_center	float	The center x-coordinate (in microns) of the capacitor bounding box
x_coordinate_max	float	The upper-right x-coordinate (in microns) of the capacitor bounding box

Table 4 Ground Capacitor Attributes (Continued)

Name	Format	Definition
x_coordinate_min	float	The lower-left x-coordinate (in microns) of the capacitor bounding box
y_coordinate_center	float	The center y-coordinate (in microns) of the capacitor bounding box
y_coordinate_max	float	The upper-right y-coordinate (in microns) of the capacitor bounding box
y_coordinate_min	float	The lower-left y-coordinate (in microns) of the capacitor bounding box

Examples

The following command finds the ground capacitors attached to net abc:

```
starrc_shell> get_ground_capacitors -of_objects abc
_sel15
```

The following command finds the ground capacitors attached to all nets whose names begin with ABC and returns only those capacitors whose layer ID is 12.

```
starrc_shell> get_ground_capacitors -of_objects ABC* \
               -filter "layer_id == 12"
_sel23
```

get_instances

Creates a collection of the instances (cells) associated with one or more nets. Valid only for transistor-level GPDs.

Syntax

```
get_instances
     [-filter expression]
```

Arguments

Option and Argument	Data Type	Description
-filter_expression	none	Refines the list of cells by using arithmetic or relational operators with the attributes of the cell objects.

Description

The command checks instance or device information of a GPD parasitic database.

Attributes of Instances

Object properties are stored in attributes. Table 5 lists the attributes available for instances.

The commands in the StarRC command file control whether some properties of cells are stored in the GPD during extraction. If the properties are not stored in the GPD, they are not available in subsequent Parasitic Explorer attribute queries.

Table 5 Instance Attributes

Name	Format	Definition
name	string	The cell name, which can be controlled by the INSTANCE_TYPE command for layout or schematic cells names used for instances.
model_name	string	The model name of the device.
length	float	The length of a device, in microns.
width	float	The width of a device, in microns.
nfin	integer	The fin number of a device, in microns.
coordinate_x	float	The device-center-x-coordinate of the cell, in microns.
coordinate_y	float	The device-center-y-coordinate of the cell, in microns.

Table 5 Instance Attributes (Continued)

Name	Format	Definition
orientation	degree	The orientation (vertical, horizonal, or non-manhattan) of the cell.
spice_card		An instance type card, where the following intances are represented as follows: • M for MOS • R for resistor • C for capacitor • L for inductance • J for JFET • Q for BJT • D for diode • X for other devices
properties_string		Other properties can be specified using the attribute.

Examples

The following example shows how to use the `get_instances` command with the `name` attribute:

```
starrc_shell> get_instances -filter "name==0\/33\/M1"
_se14
starrc_shell> report_attribute -application _se14
****************************************
Report : Instances summary
Design : add4
Version: R-2020.09
Date   : Tue Aug 18 15:11:19 2020
****************************************
Design   Object    Type    Attribute Name      Value
------------------------------------------------
add4     instance  float   coordinate_x        0.000000
add4     instance  float   coordinate_y        0.000000
add4     instance  float   length              1.000000
add4     instance  string  model_name          n
add4     instance  string  name                0/33/M1
add4     instance  int     nfin                0
add4     instance  int     orientation         0
add4     instance  string  properties_string   AD=39p AS=39p PD=32u
 PS=32u
add4     instance  string  spice_card          M
add4     instance  float   width               13.000000
```

The following example lists all instances from the parasitic file:

```
starrc_shell> get_instances
_sel2
starrc_shell> sizeof_collection _sel12
208
```

The following example sets all instances in the parasitic file:

```
starrc_shell> set all_instances [get_instances]
Information: Defining new variable 'all_instances'. (CMD-041)
_sel13
starrc_shell> sizeof_collection _sel13
108
```

See Also

- report_instances

get_point_to_point_resistance

Returns the equivalent resistance of the parasitic resistors between two nodes of a net. Valid only for transistor-level GPDs.

Syntax

```
get_point_to_point_resistance
     [-quiet]
     [-parasitic_corners corner_names]
     [-all_parasitic_corners]
     -from node1 -to node2
```

Arguments

Option and Argument	Data Type	Description
`-quiet`	none	Suppresses warning and error messages if the command does not retrieve any objects
`-parasitic_corners` *`corner_names`*	list	Specifies the corners in the GPD to query. If this option is omitted, the corner specified by the `parasitic_corner_name` variable is selected.
`-all_parasitic_corners`	none	Queries all corners that are present in the GPD
`-from` *`node1`*	string	Specifies a pin, port, or net internal node as the path startpoint. You must use the `-from` and `-to` options together.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node as the path endpoint. You must use the `-from` and `-to` options together.

Description

You can specify a node by a pin name, a port name, or a node index. To specify a node index, use the format `net_name:node_ID`. For a given net, valid node IDs are from 1 to N inclusive, where N is the number of net nodes. Note that in the GPD and in SPEF files generated from a GPD, node numbering begins at 0 and ends at N-1.

Examples

The following command finds the equivalent resistance of a path from port ABC to pin XYZ:

```
starrc_shell> get_point_to_point_resistance -from min_msb/U21/A \
              -to min_msb/U20/X
0.0176175
```

get_resistors

Creates a collection of the parasitic resistors for one or more nets.

Syntax

```
get_resistors
      [-filter expression]
      [-quiet]
      [-parasitic_corners corner_names]
      [-all_parasitic_corners]
      -of_objects nets | -from node1 -to node2
```

Arguments

Option and Argument	Data Type	Description
`-filter_expression`	none	Refines the list of resistors by using arithmetic or relational operators with the attributes of the resistor objects.
`-quiet`	none	Suppresses warning and error messages if the command does not retrieve any objects
`-parasitic_corners` *`corner_names`*	list	Specifies the corners in the GPD to query. If this option is omitted, the corner specified by the `parasitic_corner_name` variable is selected.
`-all_parasitic_corners`	none	Queries all corners that are present in the GPD
`-of_objects` *`nets`*	list	Specifies the nets for which to retrieve the parasitic resistors.
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool returns the parasitic resistors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool returns the parasitic resistors between this node and the node specified in the `-from` option.

Description

You can specify a node by a pin name, a port name, or a node index. To specify a node index, use the format `net_name:node_ID`. For a given net, valid node IDs are from 1 to N inclusive, where N is the number of net nodes. Note that in the GPD and in SPEF files generated from a GPD, node numbering begins at 0 and ends at N-1.

You must use either the -of_objects option or both the -from and -to options. The -from and -to options are valid for nets that contain loops between the nodes.

Attributes of Parasitic Resistors

Object properties are stored in attributes. Table 6 lists the attributes available for parasitic resistors, which have the object class resistor.

The commands in the StarRC command file control whether some properties of parasitic resistors are stored in the GPD during extraction. If the properties are not stored in the GPD, they are not available in subsequent Parasitic Explorer attribute queries. The following commands affect parasitic resistor attributes:

- Specifying the NETLIST_TAIL_COMMENTS: YES command stores the following attributes:
  - is_via
  - is_via_array
  - length
  - width
- Specifying the EXTRA_GEOMETRY_INFO: RES command stores the following attributes:
  - x_coordinate_max
  - x_coordinate_min
  - y_coordinate_max
  - y_coordinate_min
- Running simultaneous multicorner extraction by using the SIMULTANEOUS_MULTI_CORNER: YES command stores the following attributes:
  - resistance_max
  - resistance_min
  - resistance_multicorner
- Running single-corner extraction stores the following attribute:
  - resistance

Table 6 Prasitic Resistor Attributes

Name	Format	Definition

Feedback

Table 6 Prasitic Resistor Attributes (Continued)

Name	Format	Definition
area	float	The via area in square microns. Populated only if the `is_via` attribute is `true`; mutually exclusive with the `length` and `width` attributes.
is_short	Boolean	The value is `true` if the resistor is a shorting resistor.
is_via	Boolean	The value is `true` if the resistor is a via resistor.
is_via_array	Boolean	The value is `true` if the resistor is part of a via array.
is_via_ladder_em	Boolean	The value is `true` if the resistor is associated with a via ladder in an NDM format IC Compiler II database that has the `is_electromigration` attribute.
is_via_ladder_high_ performance	Boolean	The value is `true` if the resistor is associated with a via ladder in an NDM format IC Compiler II database that has the `is_high_performance` attribute.
layer_id	integer	The layer ID of the ITF (nxtgrd) layer. If resistor detail is not available in the GPD, the `layer_id` and `layer_name` attributes are estimated using the associated ground capacitor layers.
layer_name	string	The layer name of the ITF (nxtgrd) layer. If resistor detail is not available in the GPD, the `layer_id` and `layer_name` attributes are estimated using the associated ground capacitor layers.
length	float	The resistor length, in microns. Populated along with the width attribute only if the `is_via` attribute is `false`; mutually exclusive with the `area` attribute.
net	collection	The net that contains the parasitic resistor
node1_ground_capacitor	collection	The ground capacitor associated with node 1 of the resistor
node1_index	integer	The index of node 1, one of two nodes at which the parasitic resistor connects to the net. Each node on a net has a unique index from 1 to N, where N is the total number of nodes on the net.
node1_name	string	The name of node 1, in SPEF file format
node2_ground_capacitor	collection	The ground capacitor associated with node 2 of the resistor
node2_index	integer	The index of node 2, one of two nodes at which the parasitic resistor connects to the net.

Table 6 Prasitic Resistor Attributes (Continued)

Name	Format	Definition
node2_name	string	The name of node 2, in SPEF file format
resistance	float	A single-corner resistance value, in SPEF file format. The resistance units are kOhms (different from resistances reported in a SPEF netlist, which have units of Ohms).
resistance_max	float	The maximum value of the list in the `resistance_multicorner` attribute
resistance_min	float	The minimum value of the list in the `resistance_multicorner` attribute
resistance_multicorner	string	If data from multiple corners is retrieved, the string contains a list of the resistances of all corners specified by the `-parasitic_corners` option, in that order.
via_array_nx	integer	In a via array, the number of vias in the X direction. Populated only if `is_via_array` is `true`.
via_array_ny	integer	In a via array, the number of vias in the Y direction. Populated only if `is_via_array` is `true`.
via_array_perimeter	float	In a via array, the perimeter in microns. Populated only if `is_via_array` is `true`.
width	float	The resistor width, in microns. Populated along with the length attribute only if the `is_via` attribute is `false`; mutually exclusive with the `area` attribute.
x_coordinate_max	float	The upper-right x-coordinate (in microns) of the resistor bounding box
x_coordinate_min	float	The lower-left x-coordinate (in microns) of the resistor bounding box
y_coordinate_max	float	The upper-right y-coordinate (in microns) of the resistor bounding box
y_coordinate_min	float	The lower-left y-coordinate (in microns) of the resistor bounding box

Examples

For example, the following command finds the parasitic resistors attached to net abc:

```
starrc_shell> get_resistors -of_objects abc
{"resistor"}
```

The following command finds the parasitic resistors between nodes 10 and 20 of net abc:

```
starrc_shell> get_resistors -from_node abc:10 -to_node abc:20
{"resistor"}
```

gui_clear_parasitics

Clears parasitics annotated on a net.

Syntax

```
gui_clear_parasitics
      [nets]
      [-all]
```

Arguments

Option and Argument	Data Type	Description
nets	string	Nets for which to clear annotated parasitics. Can be a single net or a space-delimited list of nets inside double quotation marks. If not used, all nets are cleared. Wildcard * is supported.
-all	Boolean	Clears parasitic annotation for all nets; on by default.

gui_show_parasitics

Highlights parasitics for a specified set of nets.

Syntax

```
gui_show_parasitics
      [-parasitic_corners corner_name]
      [-all_parasitic_corners]
      [-aggressor_net agg_net]
      [-nores]
      [-nocg]
      [-nocc]
      [-novia]
      nets
```

Arguments

Option and Argument	Data Type	Description
nets	string	Nets for which to show parasitics. Can be a single net or a space-delimited list of nets inside double quotation marks; at least one net is required. Wildcard * is supported.
`-parasitic_corners` *corner_name*	string	The corners for which to display parasitic element values; can be a single corner name or a space-delimited list of corner names.
`-all_parasitic_corners`	Boolean	Specifies to show values from all corners.
`-aggressor_net` *agg_net*	string	An aggressor net for which to show coupling capacitance
`-nores`	Boolean	Does not display parasitic resistors.
`-nocg`	Boolean	Does not display parasitic ground capacitors.
`-nocc`	Boolean	Does not display parasitic coupling capacitors.
`-novia`	Boolean	Does not display via parasitics.

gui_show_short_regions

Displays noncritical polygons, including metal fill polygons, in the vicinity of a short identified by the StarRC tool during extraction.

Syntax

```
gui_show_short_regions
    [-gpd gpd_dir]
```

Arguments

Option and Argument	Data Type	Description
`-gpd` *`gpd_dir`*	string	The GPD generated from the StarRC extraction. The argument is the GPD directory.

report_bounding_box

Reports the approximate bounding box of specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_bounding_box -of_objects nets
```

Arguments

Option and Argument	Data Type	Description
`-of_objects` *`nets`*	list	Nets for which to report the bounding box. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Examples

The following example shows a bounding box report.

```
starrc_shell> report_bounding_box -of_objects "SUM0 B0"
========         ===========    =========    ===========    =========
Net Name         llx            lly          urx            ury
========         ===========    =========    ===========    =========
SUM0             -467.000000    11.000000    -458.000000    82.000000
B0               -497.000000    2.500000     -272.000000    82.000000
```

report_coupling_capacitors

Reports the coupling capacitors for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_coupling_capacitors
     -of_objects nets | -from node1 -to node2     [-verbose]
```

Arguments

Option and Argument	Data Type	Description
`-of_objects` *nets*	list	Nets for which to report the coupling capacitors. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
`-from` *node1*	string	Specifies a pin, port, or net internal node. The tool reports the coupling capacitors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *node2*	string	Specifies a pin, port, or net internal node. The tool reports the coupling capacitors between this node and the node specified in the `-from` option.
`-verbose`	n/a	Provides additional information about the coupling capacitors.

Description

You must use either the `-of_objects` option or both the `-from` and `-to` options.

The default report contains a section for each victim net (the nets specified in the command arguments). The victim net heading lists the total coupling capacitance for the victim net. For each aggressor net, the report lists the total coupling capacitance between the aggressor net and the victim net and its percentage with respect to the total coupling capacitance on the victim net.

The verbose report also contains a section for each victim net. It provides detailed information about the individual coupling capacitances between nodes of the victim net and nodes of the aggressor nets.

Examples

The following example shows a default coupling capacitor report.

```
starrc_shell> report_coupling_capacitors -of_objects SUM0
================================
Net: SUM0
```

```
Total capacitance: 0.013721
Report Type: Aggressors, summary
================================
Total CCAP     %Cc/Ct        Aggressor Net
==========     ======        =============
0.000925       6.741491      B0
0.000908       6.617593      A0
0.000468       3.410830      CIN
================================
```

The following example shows a verbose coupling capacitor report. Net SUM0 has two pins, 0/33/M2/s and 0-/33/M-1/s, which can be determined with the `get_pins` command.

```
starrc_shell> get_pins -of [get_nets SUM0]
{"0/33/M2/s", "0/33/M1/s"}
starrc_shell> report_coupling_capacitors -of_objects SUM0 -verbose
=================================
Net: SUM0
Total capacitance: 0.013721
Report Type: Aggressors, detailed
=================================
Victim Node Victim Lyr Aggressor Node Aggressor Lyr Capacitance %Cc/Ct
=========== ========== ============== ============= =========== ========
0/33/M2/s   SUBSTRATE  A0:24          metal1        0.000299    2.179141
SUM0:5      metal2     A0:24          metal1        0.000047    0.342541
0/33/M2/s   SUBSTRATE  A0:25          metal1        0.000060    0.437296
SUM0:5      metal2     A0:25          metal1        0.000502    3.658625
0/33/M2/s   SUBSTRATE  B0:25          metal1        0.000370    2.696596
SUM0:4      metal2     B0:25          metal1        0.000001    0.007288
...
```

report_dominant_layer_in_path

Reports the layers with the most capacitance for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_dominant_layer_in_path
     -of_objects nets | -from node1 -to node2
```

You must use either the `-of_objects` option or both the `-from` and `-to` options.

Arguments

Option and Argument	Data Type	Description
`-of_objects` *nets*	list	Nets for which to report the layer information. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
`-from` *node1*	string	Specifies a pin, port, or net internal node. The tool reports the layer information for paths between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *node2*	string	Specifies a pin, port, or net internal node. The tool reports the layer information for paths between this node and the node specified in the `-from` option.

Examples

The following example shows a dominant layer report.

```
starrc_shell> report_dominant_layer_in_path -of_objects "SUM0 B0"
================================
List of nets in specified timing path:
net1: SUM0
net2: B0
Total number of nets in the timing path: 2

R dominant layer: poly
Total R on poly: 0.568534

C dominant layer: metal1
Total C on metal1: 0.055679
```

report_ground_capacitors

The `report_ground_capacitors` command reports the ground capacitors for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_ground_capacitors
     -of_objects nets | -from node1 -to node2
```

You must use either the `-of_objects` option or both the `-from` and `-to` options.

Arguments

Option and Argument	Data Type	Description
`-of_objects` *`nets`*	list	Nets for which to report the ground capacitors. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool reports the ground capacitors between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool reports the ground capacitors between this node and the node specified in the `-from` option.

Examples

The following example shows a ground capacitor report.

```
starrc_shell> report_ground_capacitors -of_objects "SUM0 B0"
================================
Net: SUM0
Total capacitance: 0.013721
Report Type: Ground Capacitors
================================
Node            Layer       Capacitance       %Cc/Ct
====            =====       ===========       ======
0/33/M2/s       SUBSTRATE   0.000749          5.458786
0/33/M1/s       SUBSTRATE   0.000387          2.820494
SUM0:4          metal2      0.000247          1.800160
SUM0:5          metal2      0.002221          16.186867
...
================================
Net: B0
Total capacitance: 0.089779
Report Type: Ground Capacitors
================================
Node            Layer       Capacitance       %Cc/Ct
====            =====       ===========       ======
B0              metal2      0.000000          0.000000
0/38/M2/g       poly        0.000000          0.000000
0/38/M5/g       poly        0.000000          0.000000
0/54/M5/g       poly        0.000000          0.000000
...
B0:10           metal2      0.000082          0.091335
B0:11           metal2      0.001010          1.124985
```

report_instances

Creates a collection of the instances (cells) associated with one or more nets. Valid only for transistor-level GPDs.

Syntax

```
report_resistors
     [-filter expression]
```

Arguments

Option and Argument	Data Type	Description
`-filter`	list	Nets for which to report the cells. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Description

The command reports all attributes of the instances with the same format as the instance section of a SPF file. Reports instances with their name, pin or port names, model name, and their properties. Also, provides the location information of a device at the end of the report if the device location is available.

Examples

The following examples shows the `report_instances` command report:

```
starrc_shell> report_instances -filter "name==0\/33\/M1" _se14
****************************************
Report : Instances summary
Design : add4
Version: R-2020.09
Date   : Tue Aug 18 15:11:19 2020
****************************************
Instance lines
============================

M0/33/M1 GND 0/33/M1:g 0/33/M1:s GND n w=13.000u 1=1.000u AD=39p AS=39p
 PD=32u PS=32u
```

See Also

- get_instances

report_length_layerwise

Reports the distribution of length with respect to layers for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_length_layerwise -of_objects nets
```

Arguments

Option and Argument	Data Type	Description
`-of_objects` *`nets`*	list	Nets for which to report lengths. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Description

To use this command, you must perform the original extraction with the `NETLIST_TAIL_COMMENTS: YES` command to save the required information.

Examples

The following example shows a net length report. The report contains a section for each specified net with a list of layers and the length of the specified net on each layer.

```
starrc_shell> report_length_layerwise -of_objects "SUM0 B0"
=================================
Net: SUM0
Report: Layerwise length of net
=================================
metal1 21u
metal2 55.5u
=================================
Net: B0
Report: Layerwise length of net
=================================
metal1 252.5u
metal2 113u
poly   189u
```

Feedback

report_net_connectivity

Reports the ports, instances, and cells connected to the specified nets.

Syntax

```
report_net_connectivity list or collection of nets
```

Examples

The following example shows a detailed connectivity report for nets with escape characters.

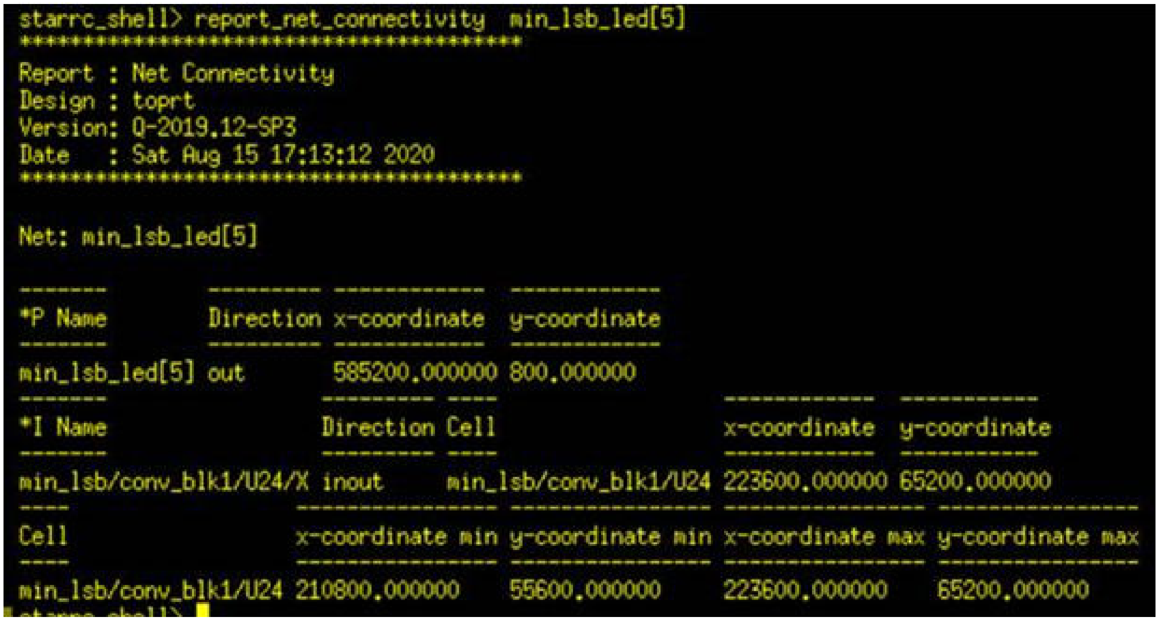
```
starrc_shell> report_net_connectivity [get_nets -exact {net\\[0\\]}]
=============================
Net: count_en
Report Type: Net Connectivity
=============================
--------   ---------   ------------   ------------
*P Name    Direction   x-coordinate   y-coordinate
--------   ---------   ------------   ------------
count_en   in          492400.000000  400.000000
--------   ----------- ----   ------------  -----------
*I Name    Direction   Cell   x-coordinate  y-coordinate
--------   ---------   ----   ------------  -----------
U86/A      in          U86    342000.000000 254600.000000
U87/A      in          U87    319600.000000 254000.000000
---- ---------------- ---------------- ---------------- ----------------
Cell x-coordinate min y-coordinate min x-coordinate max  y-coordinate max
---- ---------------- ---------------- ---------------- ----------------
U86  342000.00         254600.00         345200.00         257200.00
U87  312600.00         254000.00         319600.00         258950.00
```

Where,

- *P report has pin names, direction, and x and y coordinates.
- *I report has port names, direction, cell name, and x and y coordinates.
- Cell report has cell names, and x and y coordinates of bounding box.

Figure 44 and Figure 45 show reports for gate-level and transistor-level GPD flows, respectively.

Figure 44 Connectivity Report for Gate-Level Flow

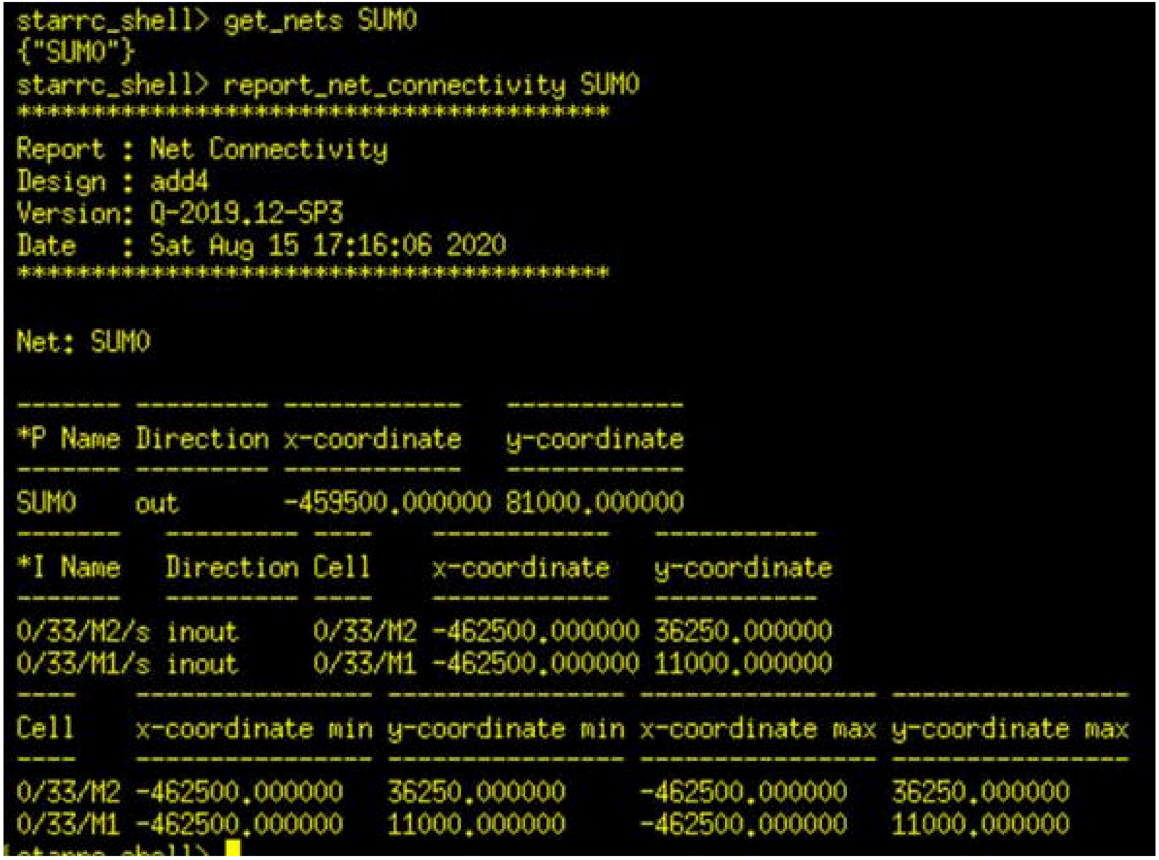


```
starrc_shell> report_net_connectivity  min_lsb_led[5]
****************************************
Report : Net Connectivity
Design : toprt
Version: Q-2019.12-SP3
Date   : Sat Aug 15 17:13:12 2020
****************************************

Net: min_lsb_led[5]

-------        --------- ------------ ------------
*P Name        Direction x-coordinate y-coordinate
-------        --------- ------------ ------------
min_lsb_led[5] out       585200.000000 800.000000
-------                 --------- ----                  ------------ -----------
*I Name                 Direction Cell                  x-coordinate y-coordinate
-------                 --------- ----                  ------------ -----------
min_lsb/conv_blk1/U24/X inout     min_lsb/conv_blk1/U24 223600.000000 65200.000000
----                  ---------------- ---------------- ---------------- ----------------
Cell                  x-coordinate min y-coordinate min x-coordinate max y-coordinate max
----                  ---------------- ---------------- ---------------- ----------------
min_lsb/conv_blk1/U24 210800.000000    55600.000000     223600.000000    65200.000000
starrc_shell>
```

Figure 45   Connectivity Report for Transistor-Level Flow



```
starrc_shell> get_nets SUMO
{"SUMO"}
starrc_shell> report_net_connectivity SUMO
****************************************
Report : Net Connectivity
Design : add4
Version: Q-2019.12-SP3
Date   : Sat Aug 15 17:16:06 2020
****************************************


Net: SUMO

------- --------- ------------   ------------
*P Name Direction x-coordinate   y-coordinate
------- --------- ------------   ------------
SUMO    out       -459500.000000 81000.000000
-------   --------- ----    ------------   -----------
*I Name   Direction Cell    x-coordinate   y-coordinate
-------   --------- ----    ------------   -----------
0/33/M2/s inout     0/33/M2 -462500.000000 36250.000000
0/33/M1/s inout     0/33/M1 -462500.000000 11000.000000
----    ---------------- ---------------- ---------------- ----------------
Cell    x-coordinate min y-coordinate min x-coordinate max y-coordinate max
----    ---------------- ---------------- ---------------- ----------------
0/33/M2 -462500.000000   36250.000000     -462500.000000   36250.000000
0/33/M1 -462500.000000   11000.000000     -462500.000000   11000.000000
starrc_shell>
```

report_nonphysical_resistors

Reports the nonphysical resistors associated with the specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_nonphysical_resistors
     -of_objects nets | -from node1 -to node2    [-verbose]
```

You must use either the `-of_objects` option or both the `-from` and `-to` options.

Arguments

Option and Argument	Data Type	Description
`-of_objects` *`nets`*	list	Nets for which to report the nonphysical resistors. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
`-from` *`node1`*	string	Specifies a pin, port, or net internal node. The tool reports the nonphysical resistors for paths between this node and the node specified in the `-to` option, which must both belong to the same net.
`-to` *`node2`*	string	Specifies a pin, port, or net internal node. The tool reports the nonphysical resistors for paths between this node and the node specified in the `-from` option.
`-verbose`	n/a	Provides additional information.

Examples

The following example shows a default nonphysical resistor report.

```
starrc_shell> report_nonphysical_resistors -of_objects min_lsb[5]

******************************************
Report : Non-Physical Resistors Net Based summary
Design : toprt
Version: Q-2019.12
Date   : Mon Nov 11 17:14:53 2019
******************************************

Net: min_lsb[5]

Node1           Node2           Resistance
=====           =====           ==========
min_lsb/U24/X   min_lsb[5]:24   0.000001
```

The following example shows a verbose nonphysical resistor report.

```
starrc_shell> report_nonphysical_resistors -of_objects min_lsb[5] \
                                           -verbose

******************************************
Report : Non-Physical Resistors Net Based detailed
Design : toprt
Version: Q-2019.12
Date   : Mon Nov 11 17:15:12 2019
******************************************

Non-Physical Resistor Categories:
A - To connect resistively connected groups (RCGs) when physical opens
    exist in the design
B - To connect electrically equivalent nodes under specific situations
  - To short bulk nodes of MOS devices
  - Superconductive metal resistors
  - To short overlapping skip cell material
  - Very small aspect ratio resistors (l<<w)
C - Shorting resistors used on device layers in a special transistor
    level flow
D - To short pin shapes that are not explicitly connected together
E - Superconductive via resistors
F - Gate adjustment resistors (Rgdelta)
G - MOS gate delta resistors
H - To detect fuse configurations in the layout

Net: min_lsb[5]

Node1           Node2          Resistance  Layer  Length   Width     Type
=====           =====          ==========  =====  ======   =====     ====
min_lsb/U24/X   min_lsb[5]:24  0.000001     M1    0.000000 10.000000  B
```

report_point_to_point_resistance

Reports the point-to-point resistance (in ohms) for all combinations of pins and instance ports for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_point_to_point_resistance -of_objects nets [-limit no_pairs]
```

Arguments

Option and Argument	Data Type	Description
`-of_objects` *nets*	list	Nets for which to report point-to-point resistance. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
`-limit` *no_pairs*	integer	Maximum number of resistances to report for each net Default: 1000

Examples

The following example shows a point-to-point resistance report.

```
starrc_shell> report_point_to_point_resistance  \
                          -of_objects min_msb/conv_blk1/n105 -limit 3

**************************************************
Report : Point to Point Resistance
Design : toprt
Version: Q-2019.12
Date   : Mon Nov 11 12:45:00 2019
**************************************************

Net: min_msb/conv_blk1/n105

Pin1                      Pin2                     P2P R
====                      ====                     =====
min_msb/conv_blk1/U7/X    min_msb/conv_blk1/U10/A  0.025563
min_msb/conv_blk1/U7/X    min_msb/conv_blk1/U11/C  0.035199
min_msb/conv_blk1/U7/X    min_msb/conv_blk1/U14/C  0.024903
```

report_resistors

Reports the parasitic resistors for specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_resistors
     -of_objects   | -from node1 -to node2     [-verbose]
```

You must use either the -of_objects option or both the -from and -to options.

Arguments

Option and Argument	Data Type	Description
-of_objects *nets*	list	Nets for which to report the parasitic resistors. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.
-from *node1*	string	Specifies a pin, port, or net internal node. The tool reports the parasitic resistors between this node and the node specified in the -to option, which must both belong to the same net.
-to *node2*	string	Specifies a pin, port, or net internal node. The tool reports the parasitic resistors between this node and the node specified in the -from option.
-verbose	n/a	Provides additional information.

Description

The parasitic resistor report is based on either nets (using the -of_objects option) or on paths (using the -from and -to options).

Examples

The following example shows a path-based parasitic resistor report.

```
starrc_shell> report_resistors -from 0/33/M2/s -to SUM0:12
================================
Net: SUM0
From: 0/33/M2/s
To: SUM0:12
Report Type: Resistors, Path Based, summary
================================
Node1          Node2         Resistance
=====          =====         ==========
0/33/M1/s      SUM0:15       0.000550
SUM0:12        SUM0:14       0.000031
SUM0:13        SUM0:14       0.000237
```

```
SUM0:13        SUM0:16       0.000031
...
```

The following example shows a net-based parasitic resistor report.

```
starrc_shell> report_resistors -of_objects "SUM0 B0"
================================
Net: SUM0
Report Type: Resistors, Net Based, summary
================================
Node1          Node2         Resistance
=====          =====         ==========
SUM0           SUM0:6        0.000357
SUM0           SUM0:7        0.000031
0/33/M2/s      SUM0:11       0.000550
0/33/M1/s      SUM0:15       0.000550
SUM0:4         SUM0:5        0.000620
...
================================
Net: B0
Report Type: Resistors, Net Based, summary
================================
Node1          Node2         Resistance
=====          =====         ==========
B0:10          B0:11         0.000229
...
```

The following example shows a verbose parasitic resistor report. Values for the resistor length and width are available only if the extraction was performed with the NETLIST_TAIL_COMMENTS command set to YES. Values for the bounding box coordinates are available only if the extraction was performed with the EXTRA_GEOMETRY_INFO command set to RES.

```
starrc_shell> report_resistors -of_objects SUM0 -verbose
=================================
Net: SUM0
Report Type: Resistors, Net Based, detailed
=================================
Node1      Node2   Resistance Layer     Length Width Area llx lly urx ury
=====      =====   ========== =====     ====== ===== ==== === === === ===
SUM0       SUM0:6  0.000357   metal2     NA     NA    NA   NA  NA  NA  NA
SUM0       SUM0:7  0.000031   metal2     NA     NA    NA   NA  NA  NA  NA
0/33/M2/s  SUM0:11 0.000550   SUBSTRATE  NA     NA    NA   NA  NA  NA  NA
0/33/M1/s  SUM0:15 0.000550   SUBSTRATE  NA     NA    NA   NA  NA  NA  NA
SUM0:4     SUM0:5  0.000620   metal2     NA     NA    NA   NA  NA  NA  NA
...
```

report_total_net_capacitance

Reports the total capacitance of specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_total_net_capacitance nets
```

Arguments

Option and Argument	Data Type	Description
nets	list	Nets for which to report the total capacitance. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Examples

The following example shows a total net capacitance report.

```
starrc_shell> report_total_net_capacitance "SUM0 B0"
*************************************
Report : Total Capacitance
Design : toprt
Version: Q-2019.12
Date   : Thu Nov 7 15:50:45 2019
*************************************
========    =================
Net Name    Total Capacitance
========    =================
SUM0        0.013721
B0          0.089779
```

report_rc_components

Reports the RC contributions of the specified nets. Valid only for transistor-level GPDs.

Syntax

```
report_rc_components -of_objects nets
```

Arguments

Option and Argument	Data Type	Description
`-of_objects` *`nets`*	list	Nets for which to report the RC components. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Examples

The following example shows an RC component report. The report contains a section for each specified net.

```
starrc_shell> report_rc_components -of_objects min_lsb_led[5]
***********************************
Report : RC Components
Design : toprt
Version: Q-2019.12
Date   : Tue Nov 12 13:23:45 2019
***********************************

Net: min_lsb_led[5]
Total Resistance: 0.152999 kOhms
Total Capacitance: 0.057662 pF

Layer  ResValue(KOhms)  %ResContribution  CapValue(pF)  %CapContribution
=====  ===============  ================  ============  ================
M1     0.003774         2.466683          0.000000      0.000000
M2     0.025163         16.446513         0.010522      18.247719
M3     0.118932         77.733841         0.047140      81.752281
VIA1   0.002250         1.470598          0.000000      0.000000
VIA2   0.002880         1.882365          0.000000      0.000000
```

report_rc_corner_ratios

Reports the nets with the largest ratio of parasitics between corners. Valid only for transistor-level GPDs.

Syntax

```
report_rc_corner_ratios -parasitic_corners corner1 corner2
     [-type object]
     [-nworst n1]
     [-nbest n2]
```

Arguments

Option and Argument	Data Type	Description
`-parasitic_corners` *`corner1 corner2`*	string	Two corners for which to report the nets with the largest capacitance ratio.
`-type` *`object`*	string	Specifies the type of parasitic object to compare. Valid values are `ground_capacitor`, `coupling_capacitor`, `resistor`. The default is `ground_capacitor`.
`-nworst` *`n1`*	integer	Specifies to report the largest ratios and the number of nets to report.
`-nbest` *`n2`*	integer	Specifies to report the smallest ratios and the number of nets to report.

Description

If neither the `-nbest` or `-nworst` options is specified, the default is `-nworst 100`.

For each net, the ratio is the capacitance (or resistance) for corner 1 divided by the capacitance (or resistance) for corner 2.

Examples

The following example shows a coupling capacitance report for corners typ and max, listing the 100 worst ratios.

```
starrc_shell> report_rc_corner_ratios -parasitic_corners {typ max}\
                       -type coupling_capacitor
**************************************
Report : RC Corner Ratios
Design : toprt
Version: Q-2019.12
Date   : Wed Nov 13 8:12:22 2019
**************************************
```

```
Parasitic Corner 1: typ
Parasitic Corner 2: max
Reporting 100 nworst nets with coupling_capacitor variation between
 corners

Net                      Ratio
===                      =====
sec_msb/cnt_blk1/n181    1.054146
min_msb/cnt_blk1/n224    1.052174
min_msb_led[3]           1.051689
min_msb/conv_blk1/n122   1.050078
...
```

The following example shows a coupling capacitance report, listing only the 10 best ratios.

```
starrc_shell> report_rc_corner_ratios -parasitic_corners {typ max}\
                       -type coupling_capacitor -nbest 10
**************************************
Report : RC Corner Ratios
Design : toprt
Version: Q-2019.12
Date   : Wed Nov 13 9:18:02 2019
**************************************

Parasitic Corner 1: typ
Parasitic Corner 2: max
Reporting 10 nbest nets with coupling_capacitor variation between corners

Net                      Ratio
===                      =====
min_msb/conv_blk1/n107   0.903774
min_msb/conv_blk1/n125   0.904806
min_lsb_led[0]           0.905907
min_lsb/conv_blk1/n89    0.906986
sec_msb/conv_blk1/n54    0.907177
min_lsb/cnt_blk1/n196    0.908030
min_lsb/conv_blk1/n97    0.908989
min_lsb_lef[4]           0.909031
min_msb/n128             0.909055
sec_msb/conv_blk1/n50    0.909223
------------------------------------------------
```

report_routed_nets

Reports the nets routed on specified layers and the total capacitance values of those nets. Valid only for transistor-level GPDs.

Syntax

```
report_routed_nets -layer layers
```

Arguments

Option and Argument	Data Type	Description
`-layer` *`layers`*	list	Layers for which to report the routed nets. Can be a single layer or a space-delimited list of layers inside double quotation marks. Wildcard * is supported.

Examples

The following example shows a routed net report. The report contains a section for each specified layer with a list of nets, the total capacitance for each net, and the percentage contribution of the layer to the total capacitance.

```
starrc_shell> report_routed_nets "metal2 metal3"
============================================
Total number of nets routed on metal2: 16
============================================
Net Name   Total Capacitance   metal2 Capacitance   %metal2/Ct
========   =================   ==================   ==========
A0         0.092668            0.012534             13.525705
A1         0.092722            0.012547             13.531848
A2         0.092721            0.012547             13.531994
A3         0.092718            0.012544             13.529196
B0         0.089779            0.012808             14.266142
...
```

scale_parasitics

Uses the Parasitic Explorer tool commands to scale parasitics.

Syntax

```
scale_parasitics
     [-config file_name]
```

Arguments

Option and Argument	Data Type	Description
`-config` *`file_name`*	string	The file includes syntax of options and arguments to specify the scaling factors and required information for the scaling resistance and capacitance.

The following options and arguments should be included in the configuration file specified with the `-config` option:

Option and Argument	Data Type	Description
`-net_list` *`net_name`*	string	List the names of nets. If you use the `-from` and `-to` options to specify a pin, port, or net, the tool ignores the nets specified with the `-net_list` option.
`-res_factor` *`resistance_factor`*	integer	Specify the scaling factor for resistance. If the scale factor is not specified, the tool sets the scale factor to 1.
`-cc_factor` *`coupling_cap_factor`*	integer	Specify the scaling factor for coupling capacitance. If the scale factor is not specified, the tool sets the scale factor to 1.
`-gc_factor` *`ground_cap_factor`*	integer	Specify the scaling factor for ground capacitance. If the scale factor is not specified, the tool sets the scale factor to 1.
`-from` *`node1`*	string	Specify the startpoint, which is a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-to` option, both nodes should belong to the same net.
`-to` *`node2`*	string	Specify the endpoint, which is a pin, port, or net internal node. The tool returns the coupling capacitors between this node and the node specified in the `-from` option, both nodes should belong to the same net.
`-layer` *`layer_name`*	string	Specify the layer name for mapping design layers. If you use the `-from` and `-to` options to specify a pin, port, or net, the tool ignores the layers specified with the `-net_list` option.

Option and Argument	Data Type	Description
`corner_start` *`corner_name`*	string	Specify a corner name to scale resistance and capacitance for the specified corner
`corner_end`		End the `corner_start` syntax with `corner_end`.

Description

The `scale_parasitics` command allows you to specify a configuration file to scale the scaling factors for resistance and capacitance, based on nets, point-to-point resitance, capacitance, GPD corners and layers.

Note that temperature sensitivity analysis, layer mapping, and tail comments are not supported with RC scale factors during simultaneous multicorner (SMC) extraction.

The following is an example that shows the syntax within the configuration file:

```
-net_list net_name -res_factor res_factor -cc_factor cc_factor \
-gc_factor gc_factor
-net_list net_name -res_factor res_factor2 -cc_factor cc_factor2 \
-gc_factor gc_factor2
-net_list net_name -from node1 -to node2 -res_factor res_factor \
-cc_factor cc_factor -gc_factor gc_factor

-layer layer_name -res_factor res_factor -cc_factor cc_factor \
-gc_factor gc_factor
-net_list net_name -layer layer_name -res_factor res_factor \
-cc_factor cc_factor -gc_factor gc_factor

corner_start corner_name
  -net_list net_name -res_factor res_factor -cc_factor cc_factor \
  -gc_factor gc_factor
  -net_list net_name -from node1 -to node2 -res_factor res_factor \
  -cc_factor cc_factor -gc_factor gc_factor
  -layer layer_name -res_factor res_factor -cc_factor cc_factor \
  -gc_factor gc_factor
corner_end
```

Consider the following rules when specifying the scaling factors:

- When you specify multiple scaling settings for resistances and capacitances, the tool performs scaling only one time on the specified nets and avoids scaling subsequently. The tool issues a warning message to indicate that the setting of resistances and capacitances are ignored.
- When you set the scale factor for coupling capacitance on a selected net, the coupling capactiance of aggressor nets are also scaled.

- When you set the scale factor for point-to-point resistor, the tool applies the scale factor on all resistors specified with the `get_resistors -from node1 -to node2` command.
- When you set the scale factor for point-to-point capacitor, the tool applies the scale factor on the capacitance with one node in the resistors specified with the `get_resistors -from node1 -to node2` command.

Examples

The following example shows how to use the `scale_parasitics` and `write_parasitics` commands:

```
# Use the Parasitic Explorer commands to specify scale factors for the
 parasitics.
starrc_shell> scale_parasitics -config

# Use the Parasitic Explorer commands to write out the GPD file after RC
 scaling.
starrc_shell> write_parasitics -pe -format gpd test.gpd
```

See Also

- write_parasitics
- Setting Up the Gate-Level Flow

set_layout_database_options

Specifies options for loading the layout of the design to be analyzed.

Syntax

```
set_layout_database_options
     [-physical_tech_lib_path file_name_list]
     [-physical_lib_path file_name_list]
     [-physical_design_path file_name_list]
     [-physical_icc2_lib lib_dir_path]
     [-physical_icc2_blocks block_name_list]
     [-physical_enable_clock_data]
     [-physical_enable_all_vias]
```

Arguments

Option and Argument	Data Type	Description
`-physical_tech_lib_path` *`file_name_list`*	list	For LEF/DEF designs, a list of LEF technology files. The technology LEF files are used to understand the physical constraints, including layer definitions, via definitions, via rules, and overlapped layer constructs. If multiple LEF files are in use, specify the technology LEF files before the cell LEF files.
`-physical_lib_path` *`file_name_list`*	list	For LEF/DEF designs, a list of LEF library files. The physical library data is used to understand physical constraints such as the shapes of pins, cells, and blocks.
`-physical_design_path` *`file_name_list`*	list	For LEF/DEF designs, a list of DEF physical data files. The data is used to understand the layout details such as available free sites and utilization density.
`-physical_icc2_lib` *`lib_dir_path`*	string	For NDM format IC Compiler II designs, the reference library directory path. All technology and cell LEF information is obtained from reference libraries in this directory. You can specify additional LEF files with the `-physical_lib_path` option. Only one reference library directory can be specified with this option. To use more than one reference library directory, use multiple instances of the `set_layout_database_options` command.
`-physical_icc2_blocks` *`block_name_list`*	list	For NDM format IC Compiler II designs, a list of block names, which are read in from the library directory path specified by the `-physical_icc2_lib` option. The tool reads only the physical data for the specified blocks.
`-physical_enable_clock_data`	none	Enables the use of physical data for clock networks. Without this option, clock nets are ignored.

Option and Argument	Data Type	Description
`-physical_enable_all_vias`	none	Enables the use of physical data for all vias.

Description

The `set_layout_database_options` command specifies the design to be analyzed.

For LEF/DEF designs, you must use the `-physical_tech_lib_path`, `-physical_lib_path`, and `-physical_design_path` options.

For NDM designs, you must use the `-physical_icc2_lib` and `-physical_icc2_blocks` options. You can optionally use the `-physical_lib_path` option.

Some of these options take a list of files as an argument. The Tcl syntax provides several ways to express a list, including the following:

- Enclose the list within curly braces. For example:

  ```
  -physical_icc2_blocks {block1 block2 block3}
  ```

- Enclose the list within square brackets and include the string “list”. For example:

  ```
  -physical_icc2_blocks [list block1 block2 block3]
  ```

If a list contains only a single item, you can use the item without braces or brackets. The following examples are all acceptable:

```
-physical_icc2_blocks block1
-physical_icc2_blocks {block1}
-physical_icc2_blocks [list block1]
```

If a list is long, use the backslash (\) character to indicate continuation to the next line. For clarity, you might want to place each list item on a separate line; however, spaces are acceptable delimiters between list items. For example:

```
-physical_icc2_blocks {block1 \
                       block2 block3  \
                       block4}

-physical_icc2_blocks [list block1 \
                            block2 block3  \
                            block4]
```

starrc_gpd_read_opens_shorts

Creates an error file that contains information in the vicinity of opens and shorts for specified nets or regions.

Syntax

```
starrc_gpd_read_opens_shorts
     [-gpd gpd_dir]
     [-error_file err_file]
     [-window bbox
     [-type err_type]
     [-limit limit]
     [-add_gui_selection]
     [-add_net_attributes option]
     [-nets net_name]
     [-summary_view]
     [-shorts_types err_type]
```

Arguments

Option and Argument	Data Type	Description
`-gpd` *`gpd_dir`*	string	The GPD generated from the StarRC extraction. The argument is the GPD directory.
`-error_file` *`err_file`*	string	An optional file name for the opens and shorts information; the default is starrc_openshort.err.
`-window` *`bbox`*	list	The design region to load. If this option is not used, the entire database is loaded. The argument is a list {x1,y1,x2,y2}, where x1 and y1 define the lower-left corner of the region and x2 and y2 define the upper-right corner.
`-type` *`err_type`*	string	Specifies which errors to analyze. Valid values are `open`, `short`, and `all` (default).
`-limit` *`limit`*	integer	The maximum number of errors to display
`-add_gui_selection`	Boolean	If used, nets with opens and shorts are highlighted when the GUI is started. On by default.
`-add_net_attributes` *`option`*	string	Valid values are `replace` (default) and `append`. If `replace`, creates user attributes starrc_drc_violation and starrc_drc_coordinates. If `append`, previous attributes are not removed.
`-nets` *`net_name`*	string	Nets for which to save extra information around opens and shorts. Can be a single net or a space-delimited list of nets inside double quotation marks. Wildcard * is supported.

Option and Argument	Data Type	Description
`-summary_view`	string	Each type of shorts and opens errors gets distinctive color of X marker to categorize the errors. See Managing Open and Short Errors Using Summary View.
`shorts_types` *`err_type`*	string	Specifies which short error types to analyza. Valid values are net unselectable, nonselected, skip_cell, fill, and blockage. In the Parasitic Explorer error browser GUI, you can • Load types of shorts errors selectively • Apply types of shorts errors to view the shorts errors • Load and sort the selected types of shorts errors for debugging

Description

The `starrc_gpd_read_opens_shorts` command creates an error file that contains detailed information in the vicinity of opens and shorts for specified nets or regions. The GPD and the star directory created after a StarRC extraction run are the sources of the design information. The Parasitic Explorer error browser then uses the generated error file to display layout information for the selected nets or regions.

Examples

The following example lists only those number of opens errors that fit within the specified design region (bounding box) in the Error Browser GUI:

```
starrc_shell> starrc_gpd_read_opens_shorts -gpd top.gpd -window
 0,0,10000,5000 -type open
```

The following example lists only those number of shorts errors that fit within the specified design region (bounding box) in the Error Browser GUI, where the shorts errors types are `net unselectable`, `nonselected`, `blockage`, and `power`:

```
starrc_shell> starrc_gpd_read_opens_shorts -gpd top.gpd -window
 0,0,10000,5000 -type short  \
-short_types (net unselectable nonselected blockage power)
```

The following example lists all shorts errors of the blockage type in the summary view:

```
starrc_shell> starrc_gpd_read_opens_shorts -gpd top.gpd -summary_view
 -type short  -short_types blockage
```

The following example lists only that number of shorts errors that fit within the specified design region (bounding box) in the summary view:

```
starrc_shell> starrc_gpd_read_opens_shorts -gpd top.gpd -summary_view
 -type short  -window 0,0,10000,5000
```

If you want to view all shorts and opens errors from the actual extracted database, instead of limiting only to the list of specified nets, use the commands as shown in the following example::

```
% StarXtract star_cmd
% StarXtract -write_short_regions -nets_file nets_file star_cmd
starrc_shell> starrc_gpd_read_opens_shorts -gpd <gpd_directory>
 -error_file error_file.txt
```

Before invoking the StarRC shell, use the `StarXtract` command to access the original GPD directory and add more nets to see additional errors. Then, use the `starrc_gpd_read_opens_shorts` command to view open and short errors in the Error Browser GUI.

See Also

- Analyzing Open and Short Errors
- Managing Open and Short Errors Using Summary View
- Viewing and Analyzing Open and Short Errors

start_gui

Invokes the Parasitic Explorer graphical user interface. The `gui_start` command is equivalent to the `start_gui` command.

write_parasitics

Writes a GPD file that is read by the Parasitic Explorer tool.

Syntax

```
write_parasitics
      [-pe]
      [-format file_format]
```

Arguments

Option and Argument	Data Type	Description
-pe		Allows the Parasitic Explorer tool to read the parasitics file
-format	string	Specifies the file format with parasitics information

Description

The `write_parasitics` command writes the GPD file after RC scaling in the Parasitic Explorer tool.

```
starrc_shell> write_parasitics -pe -format gpd test.gpd
```

See Also

- scale_parasitics

Other Supported Commands

Table 7 lists the supported commands. Many of these commands are used in common with other Synopsys tools. This list does not include all possible Tcl commands. For more information, see the command man pages.

Table 7 Supported Commands

Supported Commands	
add_to_collection	print_suppressed_messages
alias	printenv
all_inputs	printvar
all_instances	proc_args
all_outputs	proc_body
append_to_collection	query_objects
apropos	quit
collections	read_parasitics
complete_net_parasitics	redirect
copy_collection	remove_annotated_parasitics
cputime	remove_design
create_command_group	remove_from_collection
current_design	remove_host_options
current_instance	remove_license
date	remove_license_limit
define_proc_attributes	remove_user_attribute
echo	rename
error_info	report_annotated_parasitics
exit	report_app_var
filter_collection	report_attribute
find	report_design

Table 7 Supported Commands (Continued)

Supported Commands	
foreach_in_collection	report_hierarchy
get_app_var	report_host_usage
get_attribute	report_lib
get_cells	report_license_limit
get_command_option_values	report_net
get_defined_attributes	report_port
get_defined_commands	report_units
get_designs	reset_design
get_license	set_app_var
get_message_ids	set_host_options
get_nets	set_license_limit
get_pins	set_operating_conditions
get_ports	set_program_options
getenv	set_units
help	set_user_attribute
history	setenv
index_collection	sh
is_false	sizeof_collection
is_true	sort_collection
list_attributes	source
list_designs	start_hosts
list_key_bindings	start_profile
list_licenses	stop_hosts
lminus	stop_profile
ls	suppress_message

Table 7 Supported Commands (Continued)

Supported Commands	
man	unalias
mem	unsuppress_message
parallel_execute	which
parallel_foreach_in_collection	write_app_var
parse_proc_arguments	write_parasitics
post_eval	