Gowin Software Quick Start Guide

SUG918-1.7.1E,2023-12-29

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Revision History

Date	Version	Description
05/07/2020	1.0E	Initial version published.
09/07/2020	1.1E	● RTL schematic added. ● File encryption added. ● Tcl command added.
10/21/2020	1.1.1E	Use GowinSynthesis as an example to describe synthesis.
06/10/2021	1.2E	● Synplify Pro removed. ● MIPI IP in the design modified.
11/02/2021	1.3E	Some descriptions updated.
07/28/2022	1.4E	Modified the design to FIFO HS and updated the relevant descriptions.
12/20/2022	1.5E	● The function of viewing the schematic diagram of the netlist after synthesis added. ● Some figures updated.
05/25/2023	1.5.1E	● Figure 3-12 Synthesis Configuration and Figure 3-31 GAO Interface updated. ● The description of 3.9.1 Configuration updated.
08/18/2023	1.6E	The descriptions of timing optimization removed.
11/30/2023	1.7E	● create_project, import_files, and run close commands added. ● Some screenshots in Chapter 3 Quick Start updated.
12/29/2023	1.7.1E	● The title of Figure 3-3 updated to FIFO HS Configuration. ● Minor description changes.

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1 About This Guide

1.1 Purpose

This manual uses FIFO HS as an example to introduce Gowin Software and aims to help you get familiar with the usage and improve the design efficiency.

1.2 Related Documents

You can find the related documents at www.gowinsemi.com:

- SUG100, Gowin Software User Guide
- SUG935, Gowin Design Physical Constraints User Guide
- SUG101, Gowin Design Timing Constraints User Guide
- SUG114, Gowin Analyzer Oscilloscope User Guide
- SUG282, Gowin Power Analyzer User Guide
- SUG502, Gowin Programmer User Guide
- SUG550, GowinSynthesis User Guide
- SUG755, Gowin HDL Schematic Viewer User Guide
- SUG1018, Arora V Design Physical Constraints User Guide

1.3 Terminology and Abbreviations

Table 1-1 shows the abbreviations and terminology used in this manual.

Table 1-1 Terminology and Abbreviations

Terminology and Abbreviations	Meaning
AO Core	Analysis Oscilloscope Core
BSRAM	Block Static Random Access Memory
DFF	D Flip-Flop
FloorPlanner	FloorPlanner
GAO	Gowin Analyzer Oscilloscope
GPA	Gowin Power Analyzer

Terminology and Abbreviations	Meaning
I/O	Input/Output
IP Core	Intellectual Property Core
PnR	Place & Route
RTL	Register Transfer Level

1.4 Support and Feedback

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Website: www.gowinsemi.com

E-mail: support@gowinsemi.com

2 Introduction

2.1 Design Flow Introduction

Gowin Software is available in Windows and Linux. It supports GUI running mode and commands running mode. Take the GUI running mode in Windows and FIFO HS design as an instance to introduce quick start of Gowin Software.

The design uses FloorPlanner to add physical constraints, uses Timing Constraints Editor to add timing constraints, uses GAO to add GAO config file and to capture data, GPA to add GPA config file, and Programmer to download bitstream.

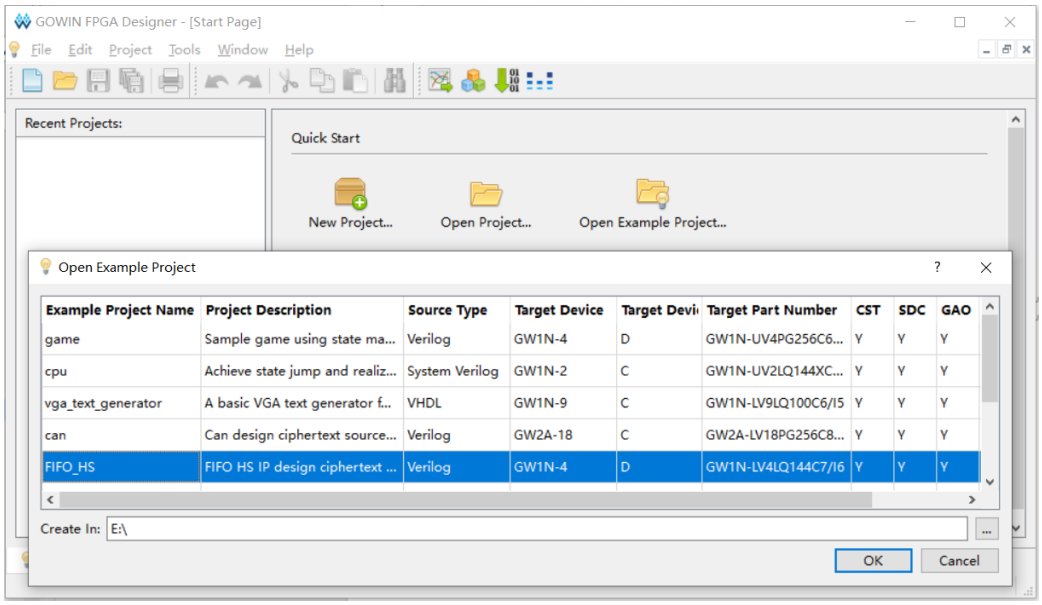
2.2 Quick Started Design Introduction

FIFO HS IP can complete the data transmission and buffering with different bit widths in the asynchronous clock domain, and configure different output control signals and data structures according to your requirements.

The whole design provides clock for FIFO HS through port, provides reset signal, enable signal and input data through logic, and finally uses GAO to collect data to verify the correctness of FIFO HS.

The design has been added to the sample project FIFO_HS, which can be quickly created by clicking "Start Page > Open Example Project…", as shown in Figure 2-1. Creating a project through the example will skip the previous steps and go directly to placement and routing, and the subsequent process. If you want to be familiar with the use of Gowin Software step by step, you can operate according to the guidelines in the document. The source files, constraint files and configuration files involved in the design are consistent with those in the sample project. You can save the files in the sample project for later use.

Figure 2-1 Open Example Project



3 Quick Start

3.1 Create a New Project

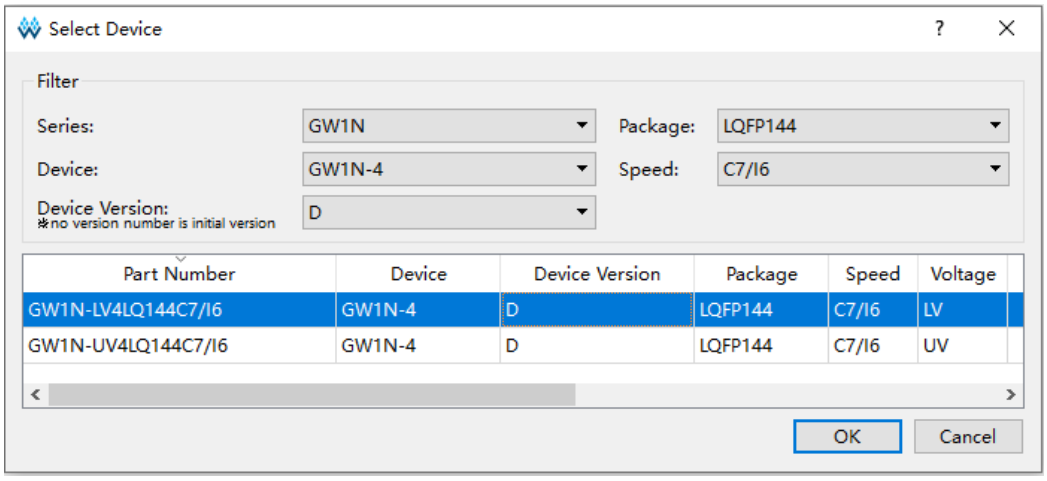
3.1.1 Create a New Project

Open Gowin Software and click "Start Page > Quick Start > New Project" to create a new project named as FIFO_HS. The device selected is as shown in Figure 3-1.

- Series: GW1N
- Device: GW1N-4
- Device Version: D
- Package: LQFP144
- Speed: C7/I6
- Part Number: GW1N-LV4LQ144C7/I6

Click "Next" until the project creation completed. For the details, please refer to *SUG100, Gowin Software User Guide*.

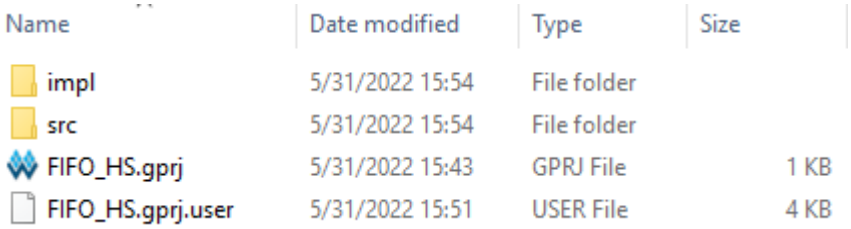
Figure 3-1 Create a New Project



After the project is created, the impl and src folders are generated under the project creation path, as shown in Figure 3-2. impl contains

synthesis and PnR files and src contains the source files.

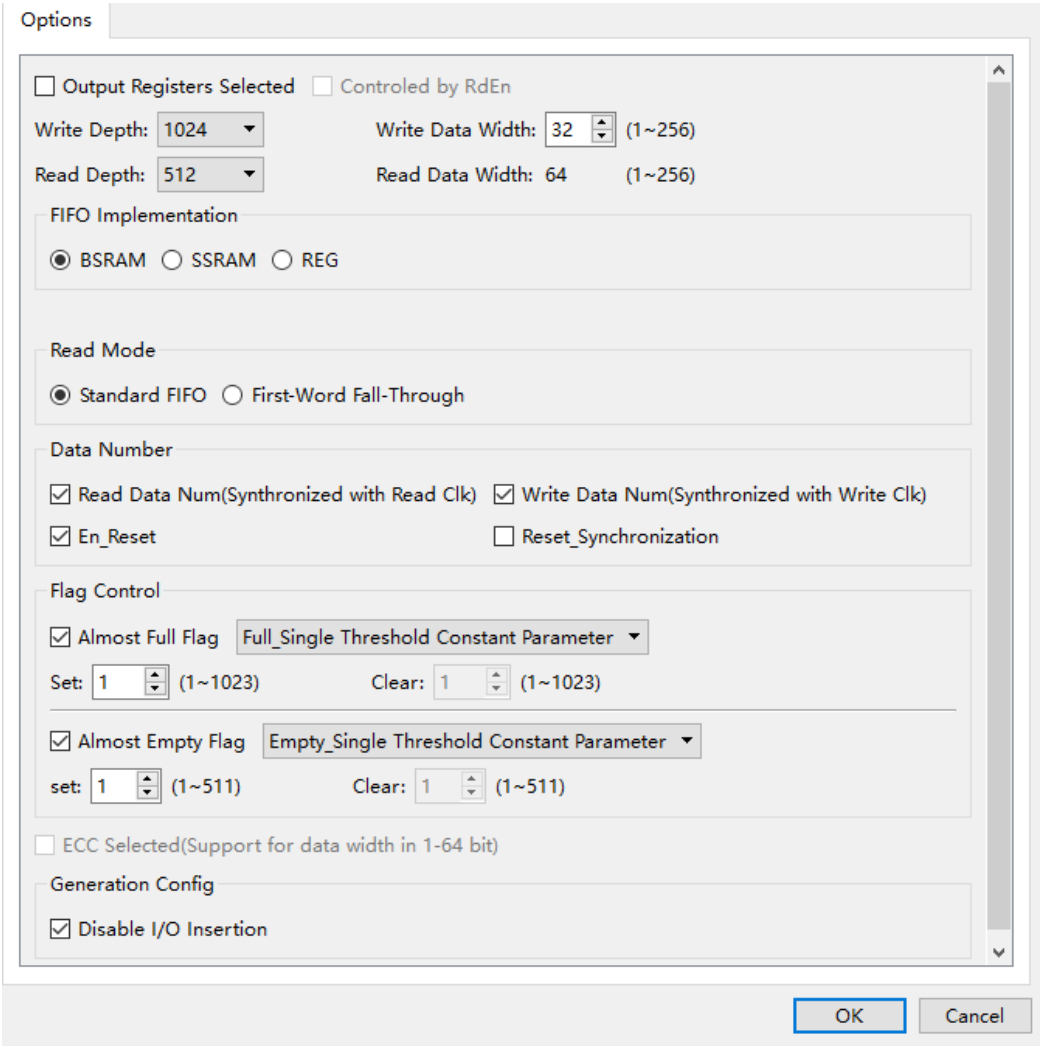
Figure 3-2 Project Directory



3.1.2 Generate FIFO HS IP

Click "Tools > IP Core Generator" to open the IP Core Generator window. Double-click "Memory Control > FIFO > FIFO HS" to open the IP Customization dialog box to configure as required. The FIFO HS configuration in this design is shown in Figure 3-3. Then click "OK" to generate FIFO HS IP.

Figure 3-3 FIFO HS Configuration



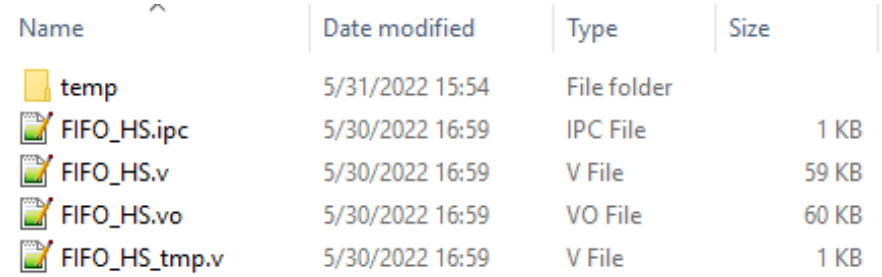
After generation, IP design files and simulation files are generated under the IP creation path, as shown in Figure 3-4.

- .v file is an IP design file, encrypted.
- _tmp.v is an IP design template file.
- .vo file is an IP simulation model file, unencrypted.
- .ipc file is an IP configuration file. The user can load the file to modify the configuration.
- temp contains the files required to generate the IP.
- The doc, model, sim, and tb contain the simulation files: readme text, simulation model, simulation script, and testbench.

Note!

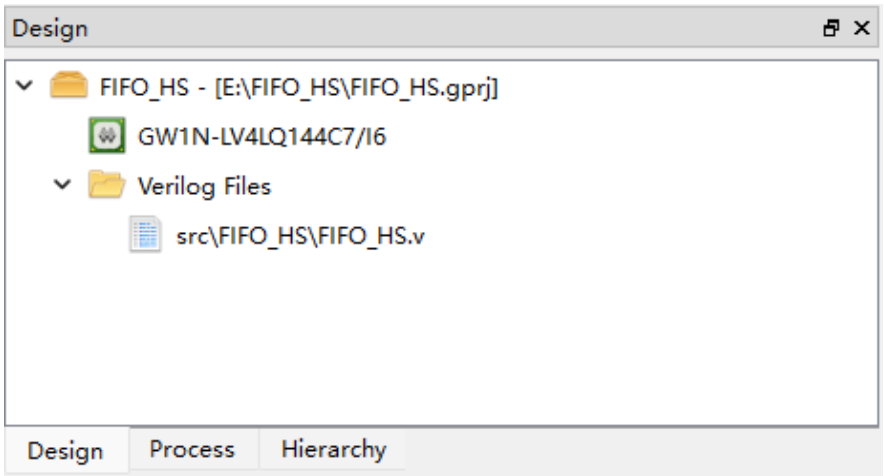
- For Gowin Software 1.9.8.06 and later versions, if VHDL is selected as the Language during IP generation, .vho file will be generated under the IP creation path, which is an IP simulation model file in plaintext.
- At present, for some IPs, the created path still generates doc, model, sim, and tb folders, indicating readme text, simulation model, simulation script, and testbench simulation file. The IP directory is subject to IP Core Generator in use.

Figure 3-4 FIFO HS IP Directory



After FIFO HS IP is generated, the Design window is as shown in Figure 3-5.

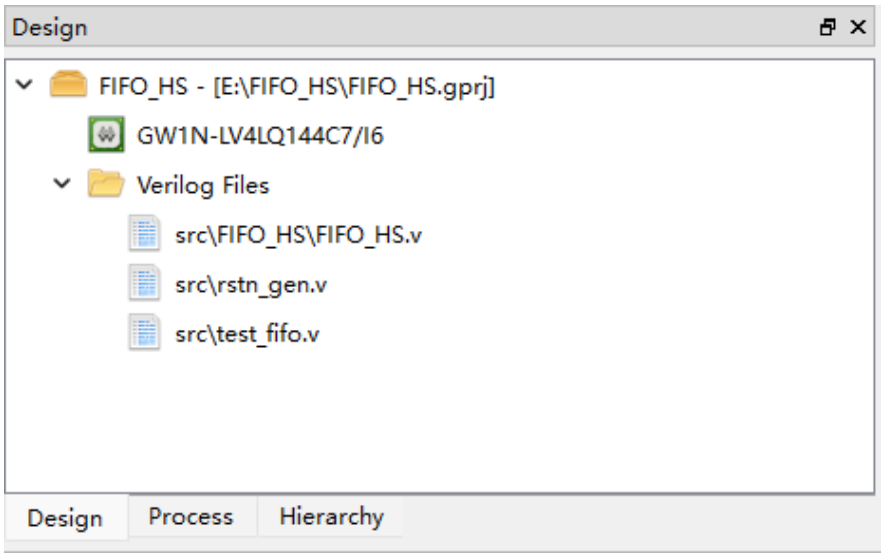
Figure 3-5 Design Window



3.1.3 Load File

In order to test FIFO HS, some design files need to be loaded or created, as shown in Figure 3-6. For the steps to load files, you can see Section 2.2 Quick Started Design Introduction.

Figure 3-6 Load Files



3.2 RTL Schematic

After the source file is loaded, you can view the RTL design schematic by clicking "Tools > Schematic Viewer > RTL Design Viewer" to help you better understand the RTL logic. For details, see *SUG755, Gowin HDL Schematic Viewer User Guide*.

3.3 GAO Configuration

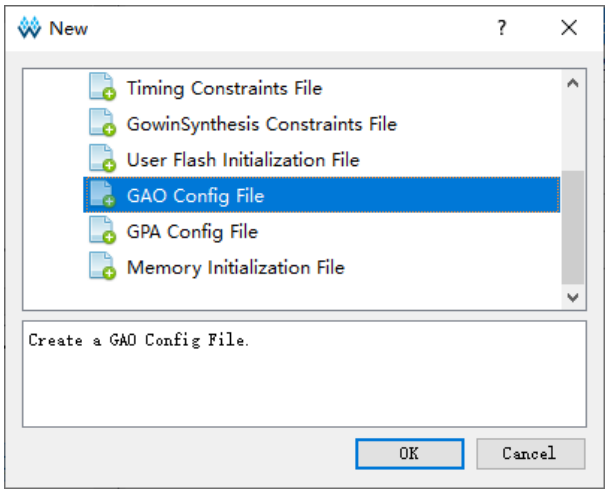
Gowin Software supports two signal capture sources: RTL-level signal capture and post-synthesis netlist-level signal capture; GAO config. file can be created after the source files are created or loaded at the RTL level, and GAO config. file can be created after the synthesis is completed at the post-synthesis netlist level. GAO config. file can be used to capture data and verify the the design. In addition, Gowin Software provides Standard Mode GAO and Lite Mode GAO. For the usage, see *SUG114, Gowin Analyzer Oscilloscope User Guide*.

This design uses RTL-level signal capture and Standard Mode GAO as an instance.

3.3.1 Create Standard Mode GAO Config File

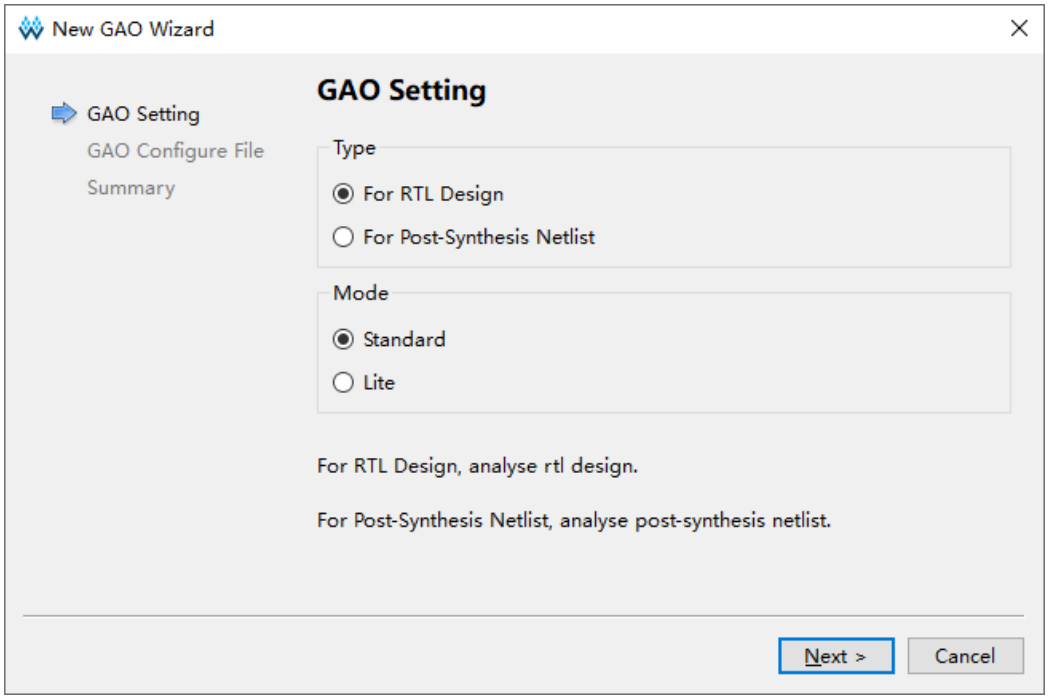
Select "Design > New File…" to open "New" dialog box, and select "GAO Config File" in "New", as shown in Figure 3-7. Click "OK".

Figure 3-7 Create GAO Config File



Select "For RTL Design" in Type, and "Standard" in Mode, as shown in Figure 3-8. Click "Next". The file name is FIFO HS. Then click "Next" until finished.

Figure 3-8 GAO Setting



3.3.2 Configure Standard Mode GAO

After file created, you can configure the number of AO cores, trigger options and capture options. The trigger options include match unit, trigger port, match type and expressions; The capture options include sample clock, capture, capture utilization and capture signals. In this design the number of AO cores is 1 and the trigger options and capture options configuration are shown in Figure 3-9 and Figure 3-10.

Figure 3-9 Trigger Options Configuration

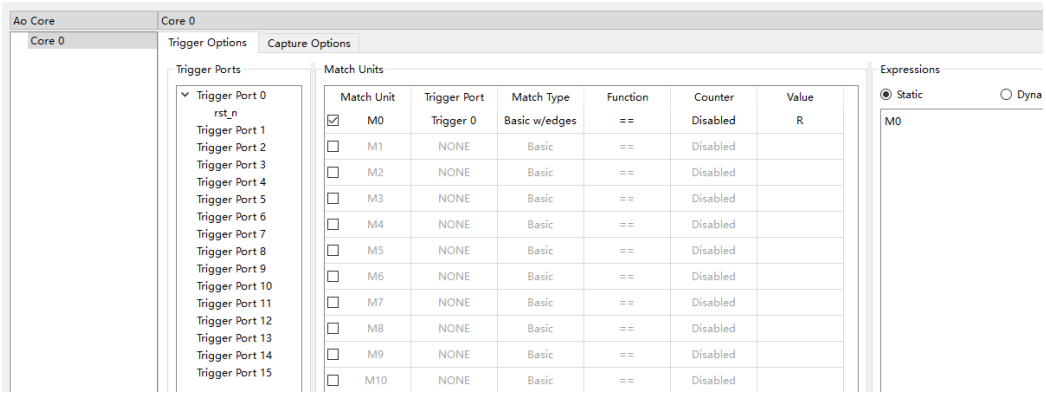
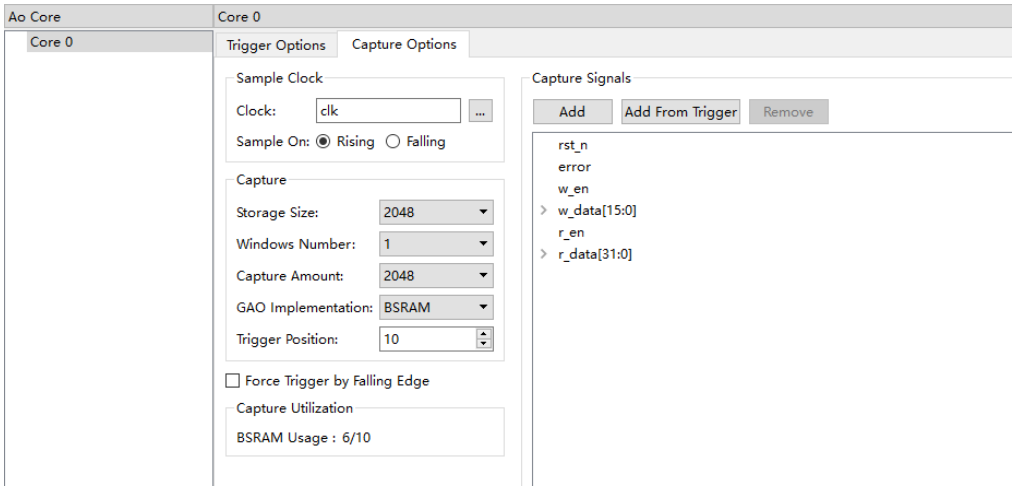
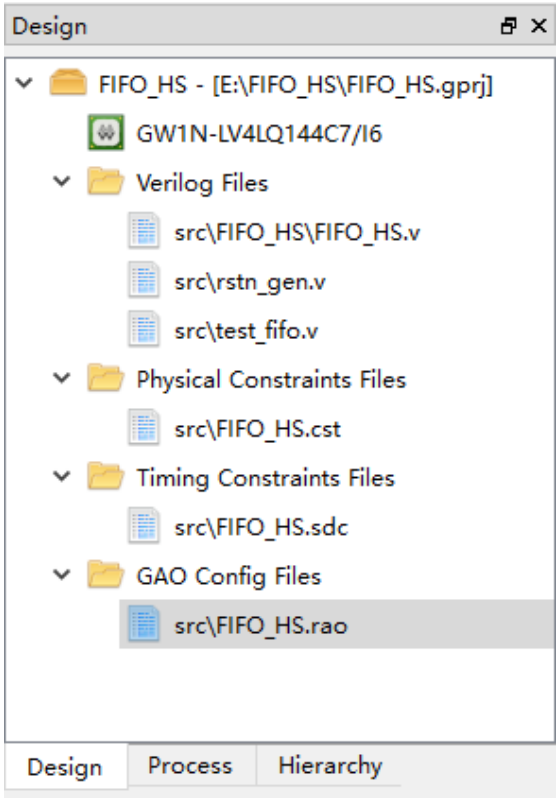


Figure 3-10 Capture Options Configuration



After configuration, click "Save" to finish and the design window is as shown in Figure 3-11.

Figure 3-11 GAO Config Files



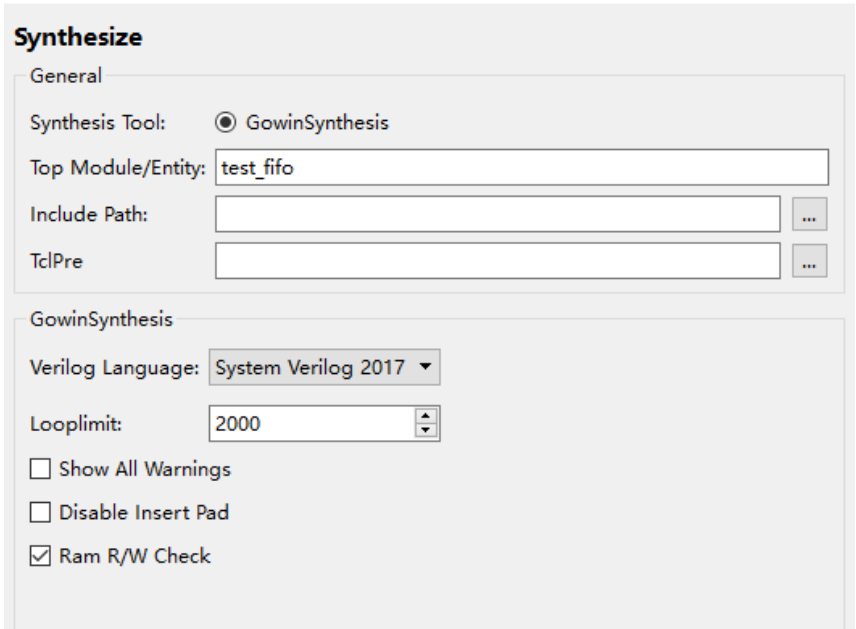
3.4 Use GowinSynthesis to Synthesize

3.4.1 Configuration

Select "Process > Synthesize (right-click) > Configuration" to open "Configuration" dialog box. For details, refer to *SUG550, GowinSynthesis User Guide*.

The top module/entity is test_fifo, as shown in Figure 3-12.

Figure 3-12 Synthesis Configuration



In addition, you can add some attributes and instructions to the source file to control synthesis. For the details, see *SUG550, GowinSynthesis User Guide*. As shown in Figure 3-13, in this design, a specific net is retained without optimization during the synthesis by using the/* synthesis syn_keep=1 */ attribute.

Figure 3-13 Attributes and Instructions of GowinSynthesis

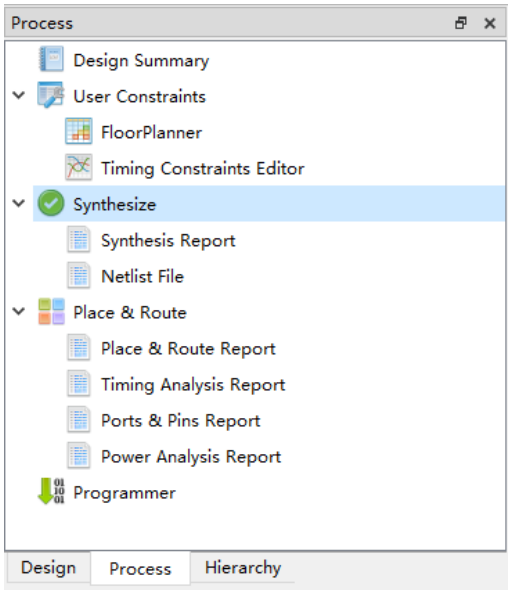
```
67  reg     [1:0]          ALT_CNT_d;
68  reg     [7:0]          rand_num;
69  reg     [9:0]          rand_cnt;
70  reg     [11:0]         start_rdmck;
71  reg                    fifo_empty_d;
72  wire    [WRSIZE-1:0] w_data_d/* synthesis syn_keep=1 */;
73  wire                   load;
74  wire    [RDSIZE-1:0] r_data;
75  wire    [WNSIZE:0]   w_num;
76  wire    [RNSIZE:0]   r_num;
77  wire                   fifo_full;
78  wire                   fifo_empty;
79  wire                   fifo_alempty;
80  //test state machine
```

3.4.2 Synthesize

After synthesis configuration, you can start to synthesize.

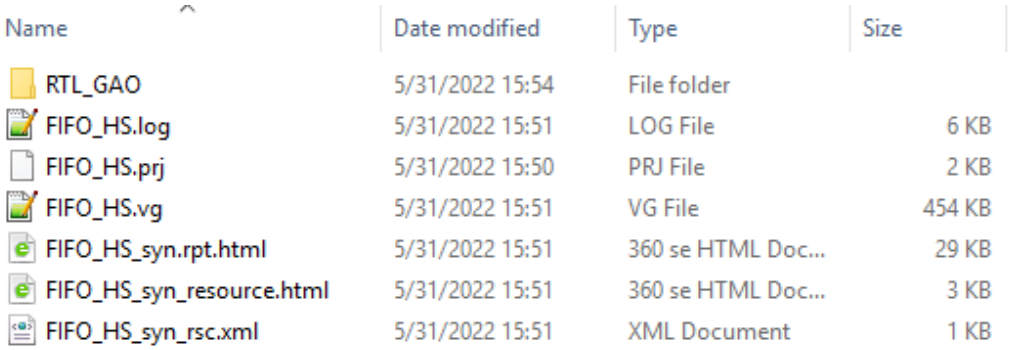
Double-click "Synthesize" in Process window to synthesize, as shown in Figure 3-14. When the icon changes to " ", you can double-click Synthesis Report to view the report and double-click Netlist File to view the netlist file.

Figure 3-14 Synthesis Completed



After synthesis, the gwsynthesis folder is generated under the \impl path. The folder contains all the files and folders generated in synthesis, as shown in Figure 3-15.

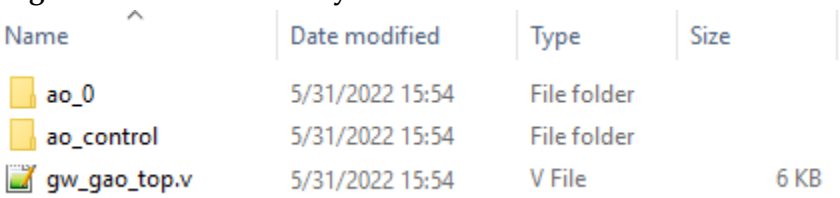
Figure 3-15 gwsynthesis Directory



If the project contains the GAO config file, after PnR, RTL_GAO folder is generated under the project creation path \impl\gwsynthesis, as shown in Figure 3-15, and this folder contains all the files generated by the RTL GAO synthesis as shown in Figure 3-16.

- ao_0 contains the parameter files of the AO core.
- ao_control contains the parameter files of the control AO core.
- gao.v is the netlist file GAO post-synthesis, encrypted.
- gw_gao_top.v is the top file of GAO, connecting ao, ao_control and jtag modules.
- The other files are generated during GAO synthesis.

Figure 3-16 GAO Directory



3.5 View Schematic Diagram of the Netlist after Synthesis

After completing the synthesis, you can view the schematic diagram of the entire design through the menu bar "Tools > Schematic Viewer > Post-Synthesis Netlist Viewer" to help you better understand the logic of the design after synthesis. For more details, see *SUG755-1.2.1E_Gowin HDL Schematic Viewer User Guide*.

3.6 Physical Constraints

After synthesis, you can use FloorPlanner or write manually to add physical constraints. In this design, FloorPlanner is selected. For more details, please refer to the *SUG935, Gowin Design Physical Constraints User Guide* and *SUG1018, Arora V Design Physical Constraints User Guide*.

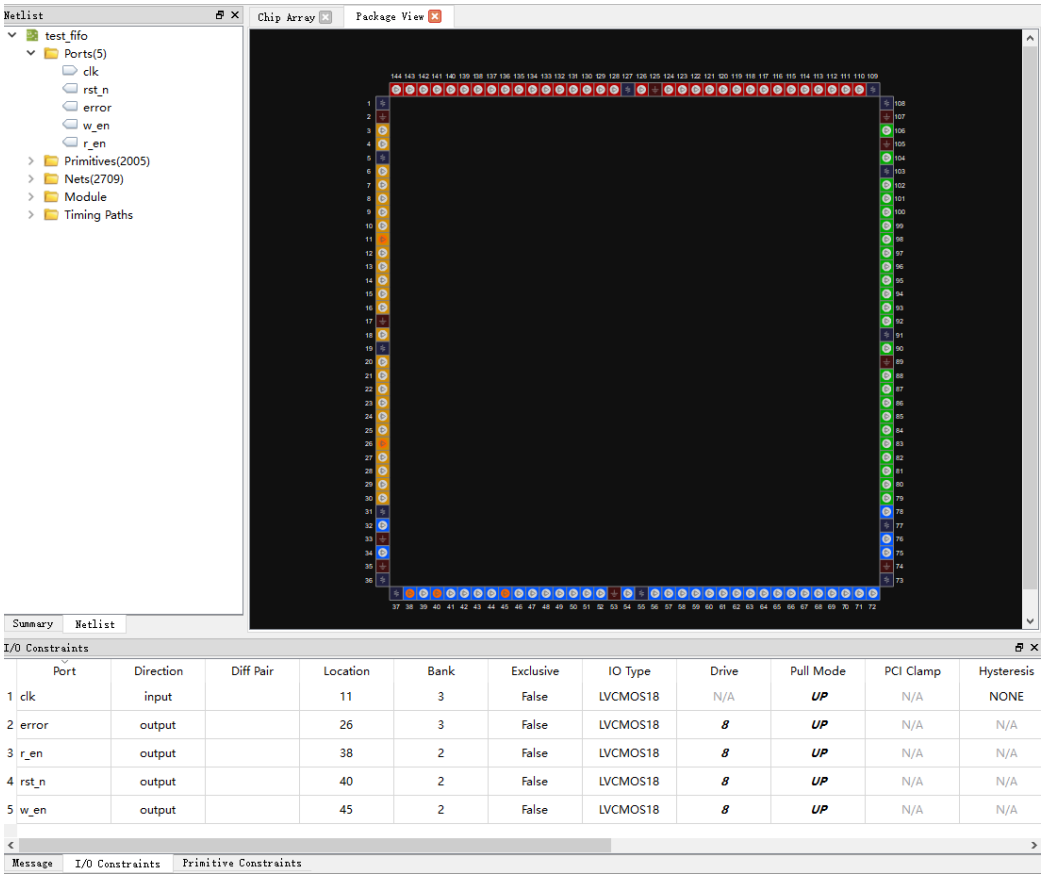
3.6.1 Create New Physical Constraints

Click "Process > User Constraints > FloorPlanner" to open

FloorPlanner, which supports I/O, Primitive, and Group physical constraints. This design only adds I/O constraints and uses it as an instance.

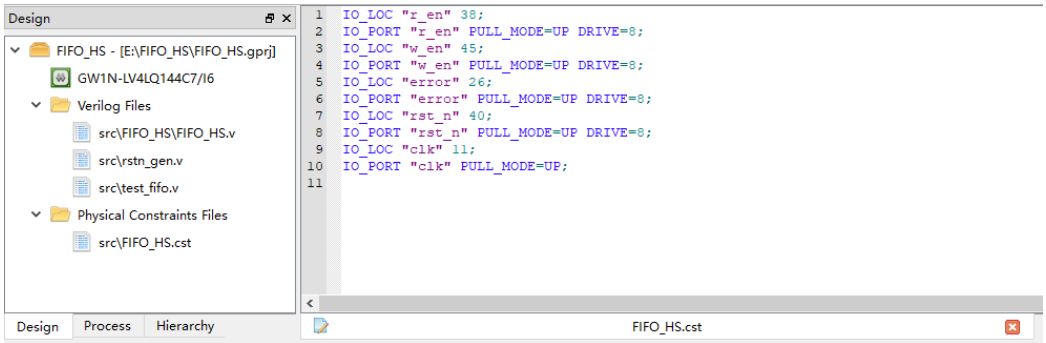
You can create I/O constraints in I/O Constraints window. Drag the port row to be constrained in the Netlist or I/O Constraints window to a specific location in the Package View or Chip Array view. After finished, the port location displays in the IOB, as shown in Figure 3-17.

Figure 3-17 I/O Constraints



After constraints finished, click "Save" to generate physical constraints files as shown in Figure 3-18.

Figure 3-18 Physical Constraints Display



In PnR, if there is no physical constraints file, the PnR will be automatically performed. If there is a physical constraint file, the PnR will

be performed according to the physical constraints file.

3.6.2 Modify Physical Constraints

After physical constraints files generated, you can modify the constraints by FloorPlanner. Click "Save" to finish.

3.7 Timing Constraint

After synthesis, you can use Timing Constraints Editor or write manually to add timing constraints. In this design, Timing Constraints Editor is selected. For more details, please refer to *SUG101, Gowin Design Timing Constraints Guide*.

3.7.1 Create New Timing Constraints

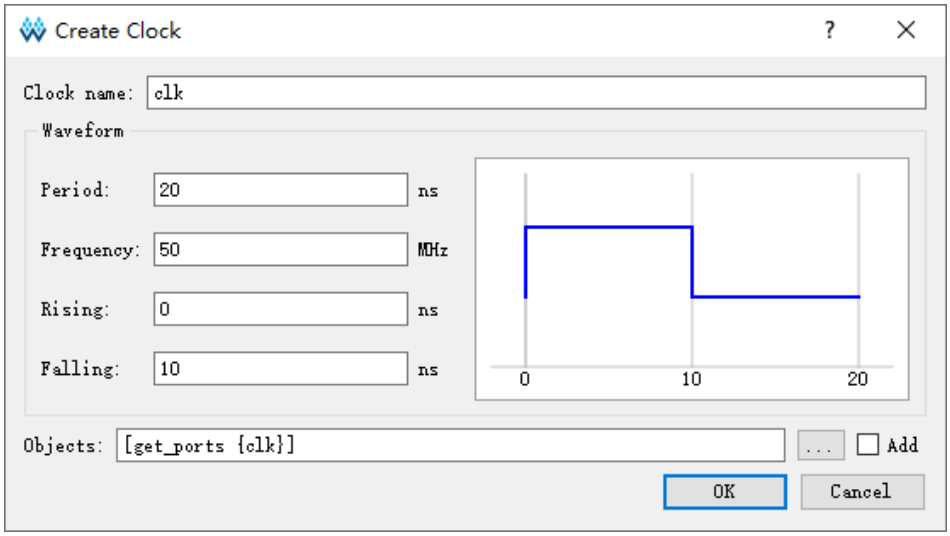
Click "Process > User Constraints > Timing Constrains Editor" to open Timing Constrains Editor, which supports clock, I/O and timing report constraints. This design adds clock and timing report constraints and uses them as instances.

Clock Constraints

Select "Clocks" under "Timing Constraints", right-click in the blank space on the right and select "Create Clock". This will open the "Create Clock" dialog, as shown in Figure 3-19. And create the following constraints:

- Clock name: clk
- Period: 20
- Frequency: 50
- Rising: 0
- Falling: 10
- Source Object: get_ports {clk}

Figure 3-19 Clock Constraints

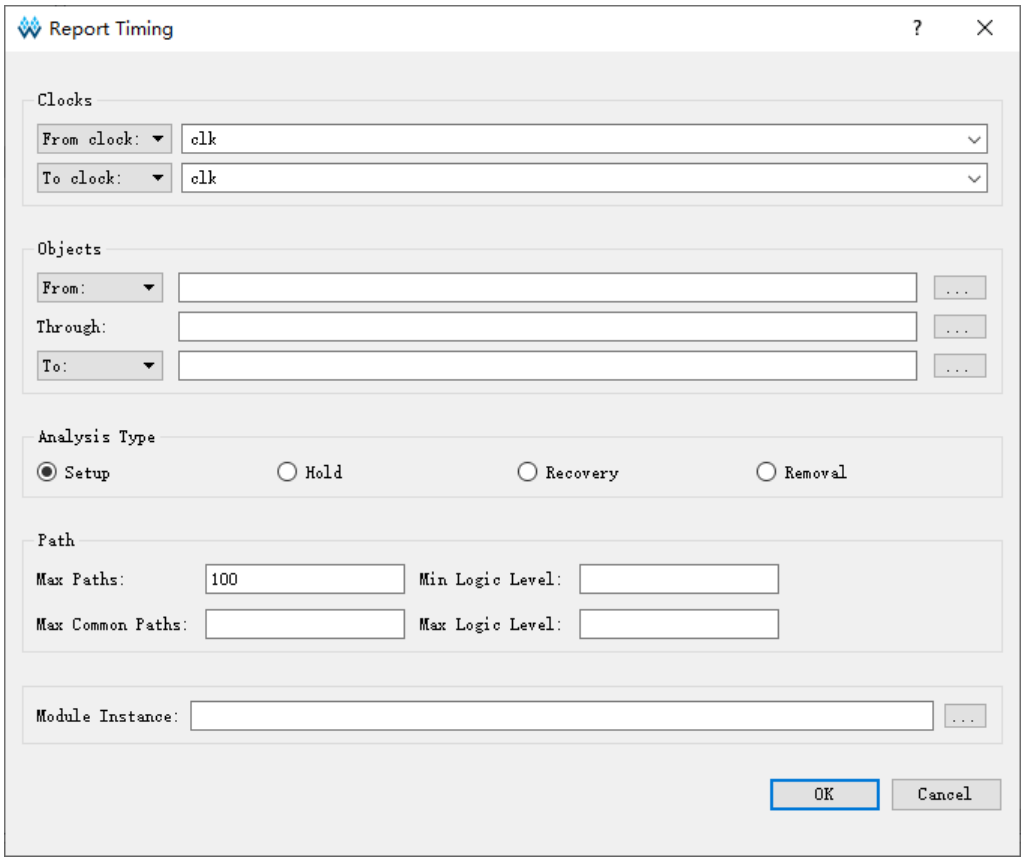


The design uses GAO, so the clock tck_pad_i is created in the same way as clk. The relationship between clk and tck_pad_i is an asynchronous clock. If you do not want to use Gowin Software to analyze this relationship, you can create a clock group constraint through the timing constraint editor.

Timing Report Constraint

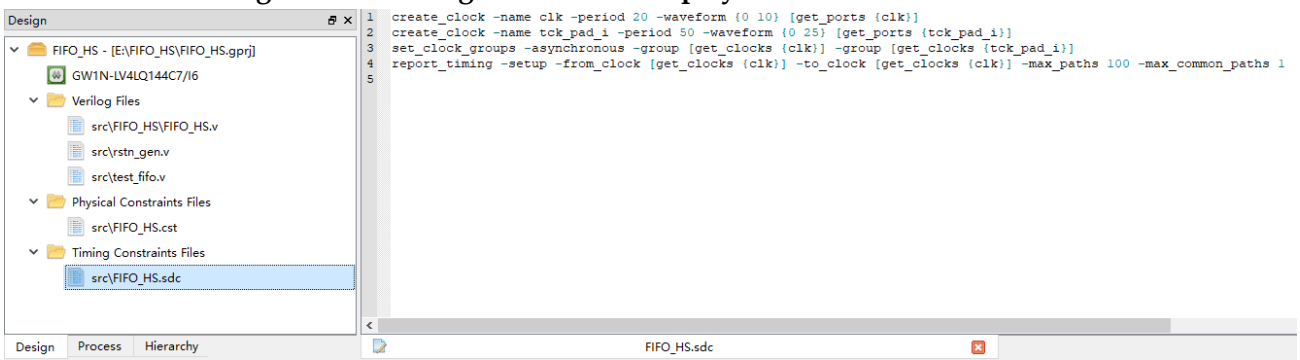
Select "Timing Constraints > Report > Report Timing", right-click in the blank space on the right and select "Create Report". In the popped-up "Report Timing" dialog, configure the parameters; the setup paths for clk to clk are reported, limiting the number of paths to 100, as shown in Figure 3-20.

Figure 3-20 Timing Report Constraint



After constraints is finished, click "Save" to generate timing constraints, as shown in Figure 3-21.

Figure 3-21 Timing Constraints Display



In PnR, if there is no timing constraints file, the PnR will be automatically performed. If there is a timing constraint file, the PnR will be performed according to the timing constraints file.

3.7.2 Modify Timing Constraints

After timing constraints files are generated, you can modify the constraints by Timing Constrains Editor. Click "Save" to finish.

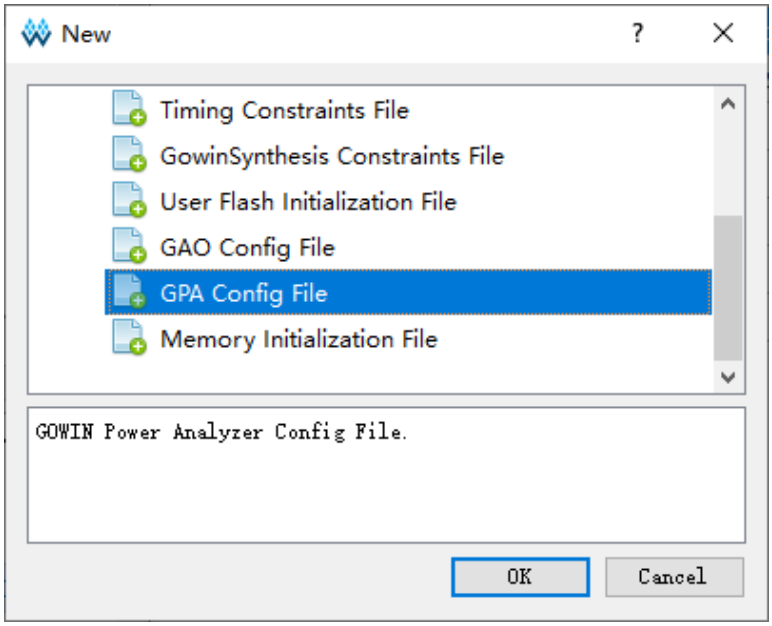
3.8 GPA Configuration

After synthesis, you can create a GPA config file to analyze power. For the usage, please refer to *SUG282, Gowin Power Analyzer User Guide*.

3.8.1 Create GPA Config File

Select "Design > New File…" to open "New" dialog box, and select "GPA Config File" in "New", as shown in Figure 3-22. Click "OK". The file name is FIFO_HS and the file is under src by default. Then click "OK" to finish.

Figure 3-22 Create GPA Config File



3.8.2 Configure GPA

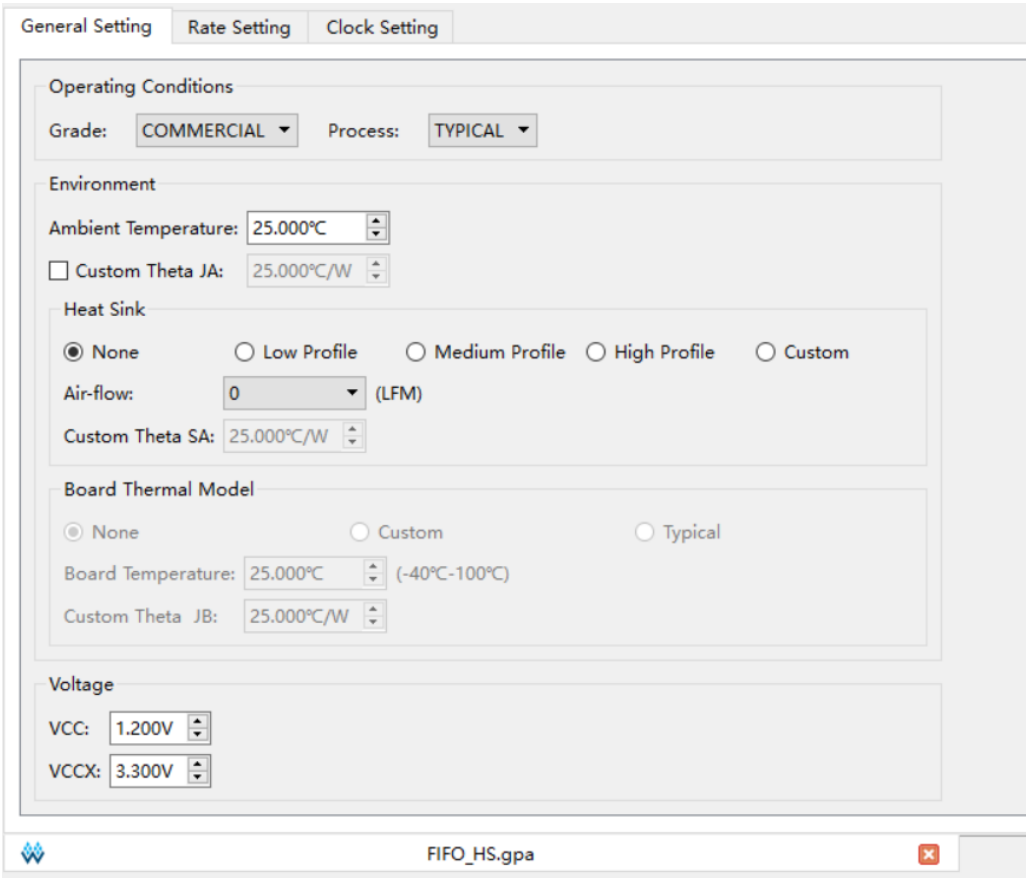
After GPA config file is created, configure General Setting, Rate Setting and Clock Setting.

- General Setting includes the parameters of device, package, speed grade, temperature grade, thermal impedance, and voltage.
- Rate Setting is used to configure signal transition rate. You can set transition rate of IO or Net, or use the default value.
- Clock Setting is used to configure clock and enable features of BSRAM, I/O and DFF.

General Setting

In this design, the general setting is configured as follows: commercial temperature, 25℃ ambient temperature, no heat sink, VCCX 3.3V and VCC 1.2V, as shown in Figure 3-23.

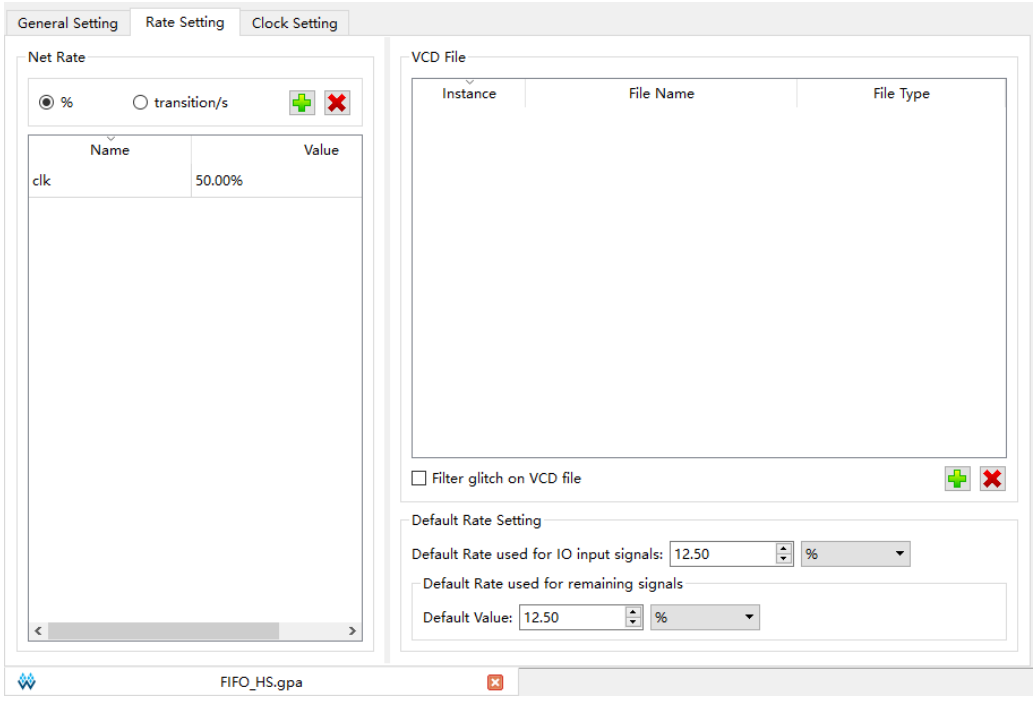
Figure 3-23 General Setting Configuration



Rate Setting

In this design, the transition rate of clk is 50% and the remaining signals use the default value 12.5%, as shown in Figure 3-24.

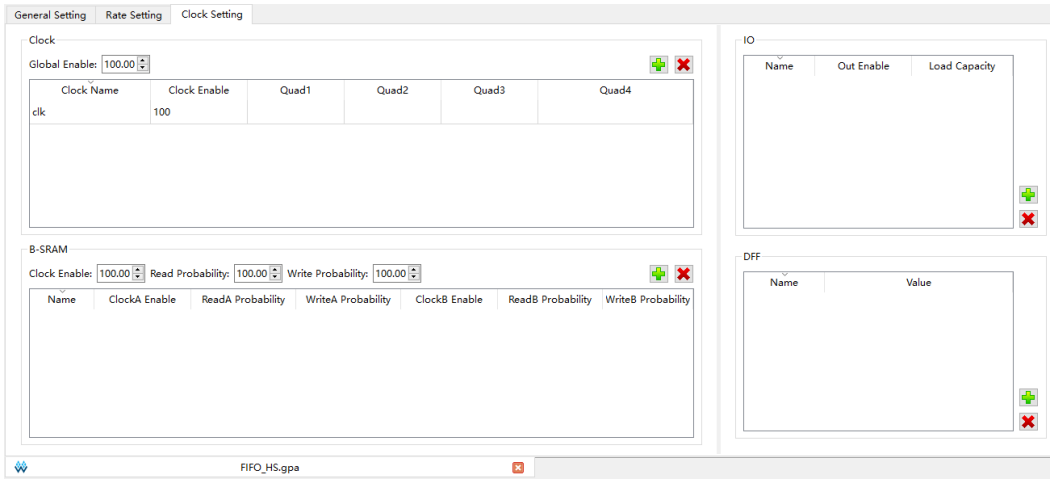
Figure 3-24 Rate Setting Configuration



Clock Setting

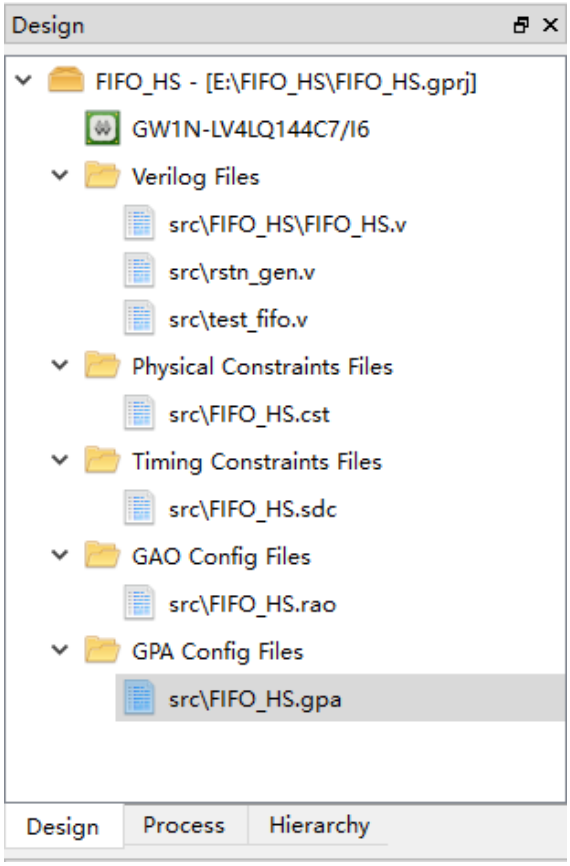
In this design, the clock is created in the timing analysis, and the rest are not set, as shown in Figure 3-25.

Figure 3-25 Clock Setting Configuration



After configuration, click "Save" to finish and the design window is as shown in Figure 3-26.

Figure 3-26 GPA Config Files



In PnR, if there is no GPA config file, the PnR will be automatically performed. If there is a GPA config file, the PnR will be performed according to the GPA config file.

3.9 Place & Route

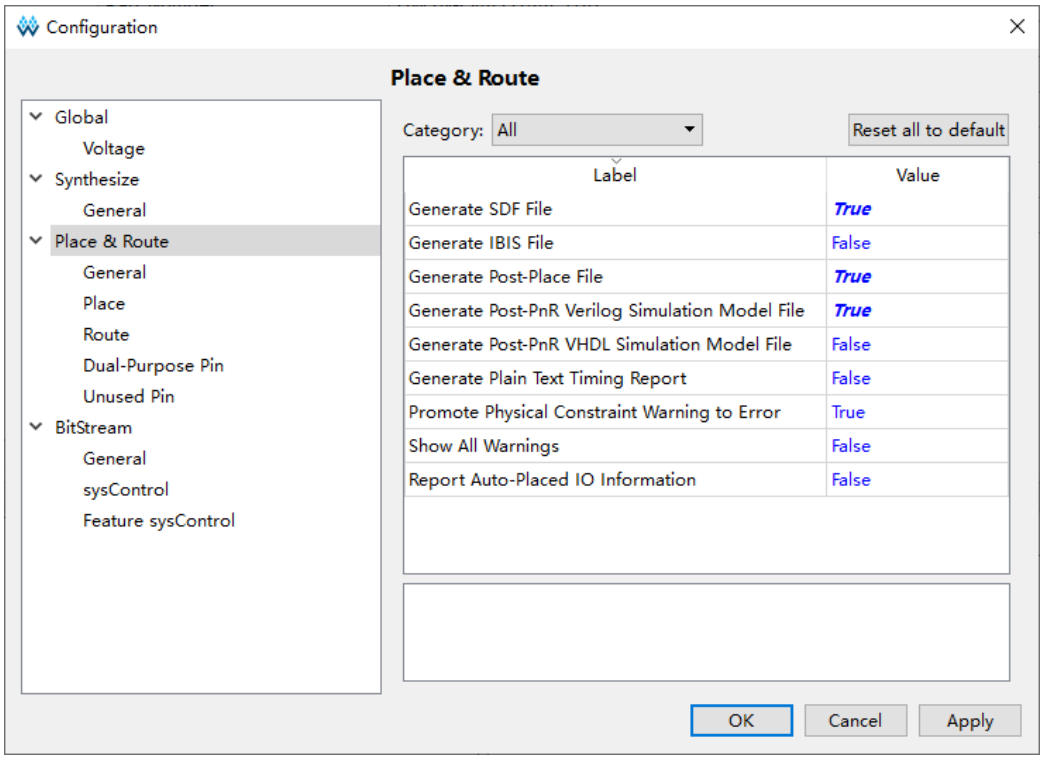
After synthesis and the creation of physical constraints files, timing constraints file, GPA config file as required, you can start PnR.

3.9.1 Configuration

Select "Process > Place & Route (right-click) > Configuration" to open "Configuration" dialog box to configure Place & Route and Bitstream. For the details, see *SUG100, Gowin Software User Guide*.

In this design, "Generate SDF File", "Generate Post-Place File" and "Generate Post-PNR Verilog Simulation Model File" in "General" option are configured to True. "Place output register to IOB" in "Plcae" option is configured to False, and the rest options use default values, as shown in Figure 3-27.

Figure 3-27 Place & Route Configuration

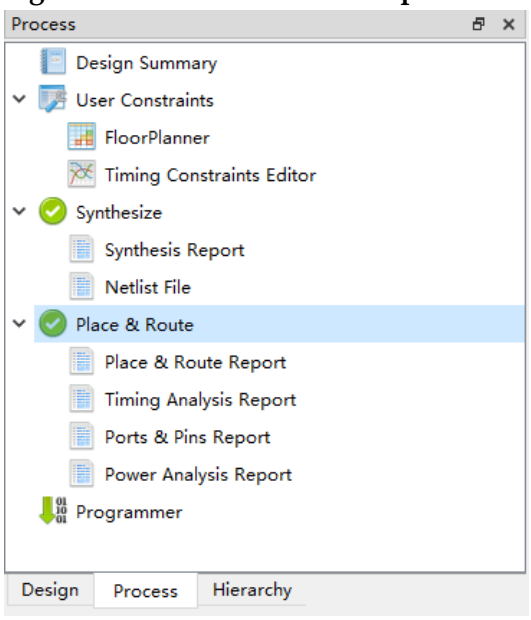


3.9.2 Run PnR

After configuration, you can run PnR.

Double-click Place & Route in Process window to start PnR based on physical constraints and GAO configuration, start timing analysis based on timing constraints, and start power analysis based on power analysis configuration. After PnR, the icon before the Place & Route changes to " ", as shown in Figure 3-28.

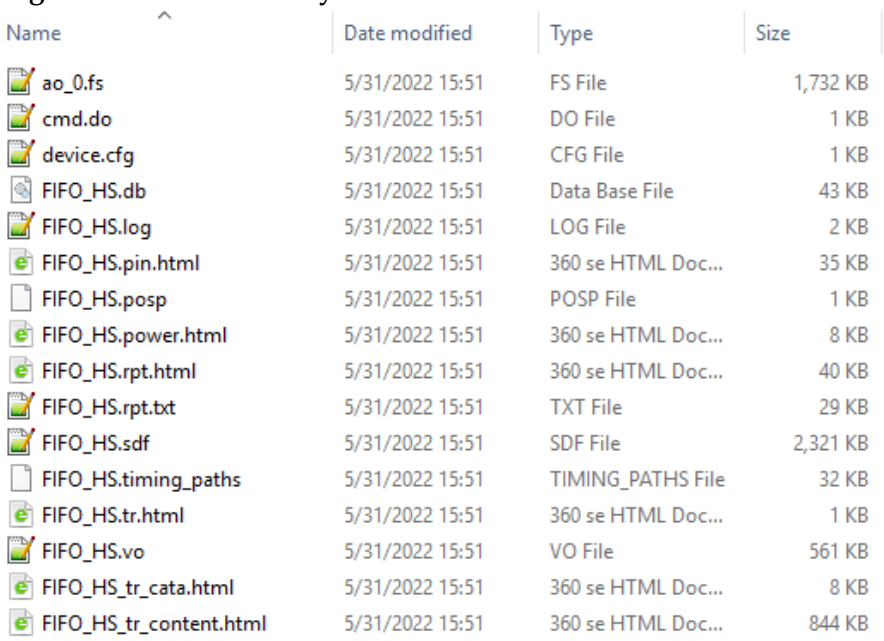
Figure 3-28 Place & Route Completed



After finishing PnR, the pnr folder is generated under the project

creation path \impl, as shown in Figure 3-29. The folder contains all the files generated in PnR, including the bitstream file, the netlist file after PnR, and the output reports. For the details, refer to 3.12 Output Files.

Figure 3-29 PnR Directory



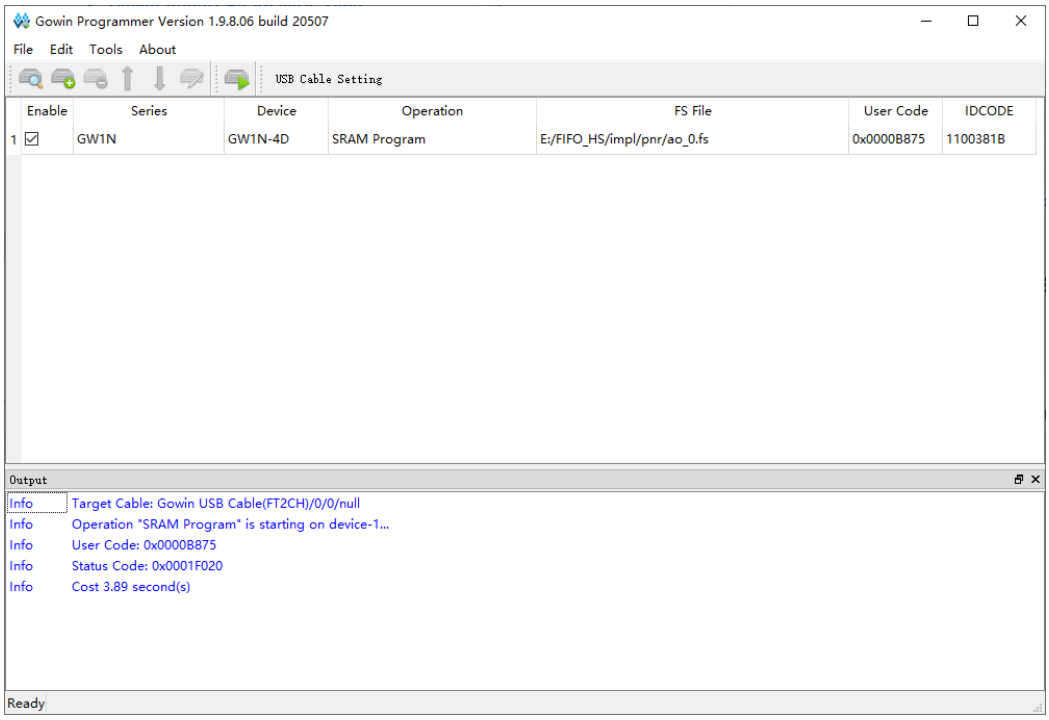
Name	Date modified	Type	Size
ao_0.fs	5/31/2022 15:51	FS File	1,732 KB
cmd.do	5/31/2022 15:51	DO File	1 KB
device.cfg	5/31/2022 15:51	CFG File	1 KB
FIFO_HS.db	5/31/2022 15:51	Data Base File	43 KB
FIFO_HS.log	5/31/2022 15:51	LOG File	2 KB
FIFO_HS.pin.html	5/31/2022 15:51	360 se HTML Doc...	35 KB
FIFO_HS.posp	5/31/2022 15:51	POSP File	1 KB
FIFO_HS.power.html	5/31/2022 15:51	360 se HTML Doc...	8 KB
FIFO_HS.rpt.html	5/31/2022 15:51	360 se HTML Doc...	40 KB
FIFO_HS.rpt.txt	5/31/2022 15:51	TXT File	29 KB
FIFO_HS.sdf	5/31/2022 15:51	SDF File	2,321 KB
FIFO_HS.timing_paths	5/31/2022 15:51	TIMING_PATHS File	32 KB
FIFO_HS.tr.html	5/31/2022 15:51	360 se HTML Doc...	1 KB
FIFO_HS.vo	5/31/2022 15:51	VO File	561 KB
FIFO_HS_tr_cata.html	5/31/2022 15:51	360 se HTML Doc...	8 KB
FIFO_HS_tr_content.html	5/31/2022 15:51	360 se HTML Doc...	844 KB

3.10 Download Bitstream

Run Place & route to generate the bitstream file and download it with Programmer to verify the design. For the usage, please see *SUG502, Gowin Programmer User Guide*.

Select "Process > Program Device (double-click)" to open Programmer, and the programmer automatically identifies the bitstream file. After the development board is ready, click "Program/Configure" to download the bitstream to the development board. Figure 3-30 shows the completion of the bitstream download.

Figure 3-30 Programmer

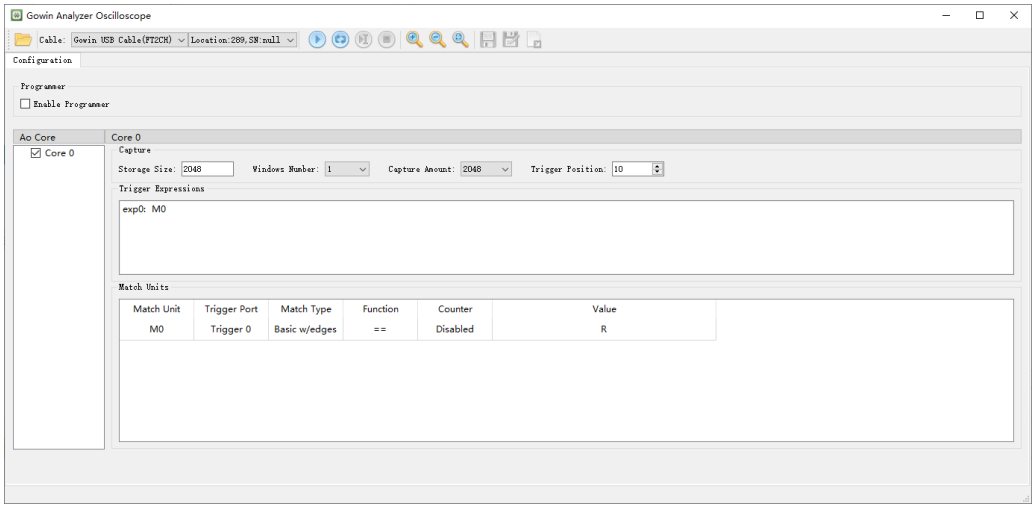


3.11 GAO Captures Data

After the bitstream is downloaded, you can use GAO to verify the design. For the usage, refer to the *SUG114, Gowin Analyzer Oscilloscope User Guide*.

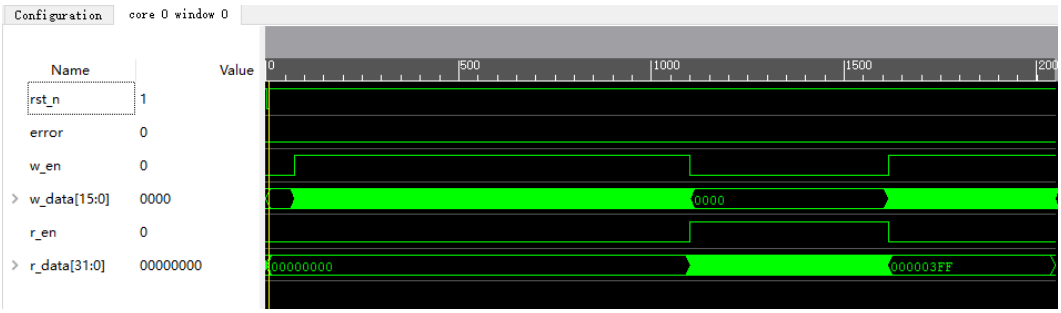
Click the GAO icon in the Gowin Software toolbar to open the GAO interface, which automatically identifies the GAO config file, as shown in Figure 3-31.

Figure 3-31 GAO Interface



Click the Start icon in the GAO interface to capture data. After finishing capturing data, GAO interface generates a window to display the waveform, as shown in Figure 3-32. The window supports cursor, zoom-out and so on so as to facilitate you to analyze the data.

Figure 3-32 GAO Waveform Display



3.12 Output Files

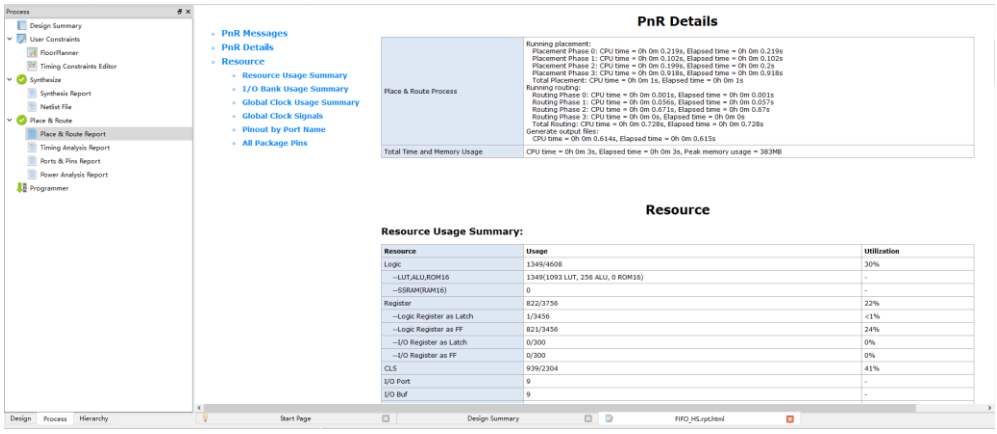
3.12.1 Place & Route Report

The Place & Route Report describes the resource, memory consumption, time consumption, etc. occupied by the user design, with the file extension name .rpt.html. Check the *.rpt.html file for further details.

Double-click "Place & Route Report" in the Process window to open Place & Route report, as shown in Figure 3-33.

For the details, refer to 6.2 Place & Route Report of *SUG100 Gowin Software User Guide*.

Figure 3-33 Place & Route Report



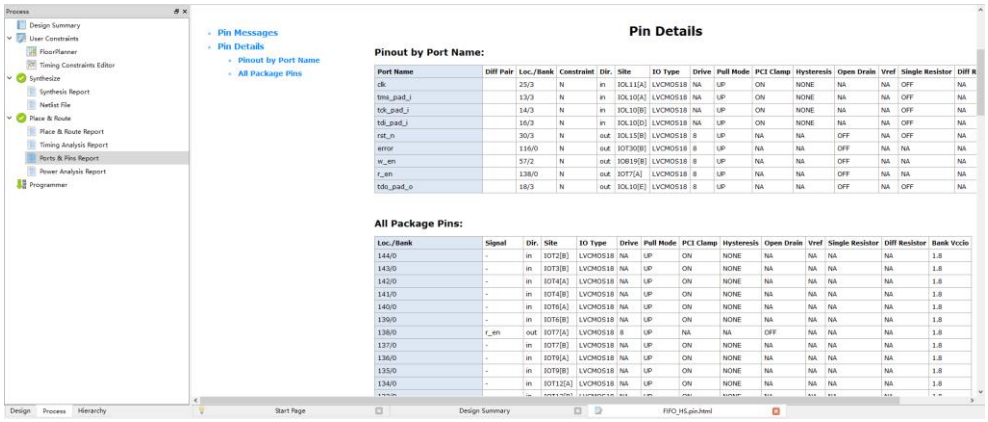
3.12.2 Ports and Pins Report

The Ports and Pins Report is the ports and pins files after placement. It includes port types, attributes, and locations, etc. The generated file is saved with extension name .pin.html. Check the .pin.html file for further details.

Double-click Ports & Pins Report in the Process window to open Ports & Pins Report, as shown in Figure 3-34.

For the details, refer to 6.3 Ports & Pins Report of *SUG100，Gowin Software User Guide*.

Figure 3-34 Ports & Pins Report



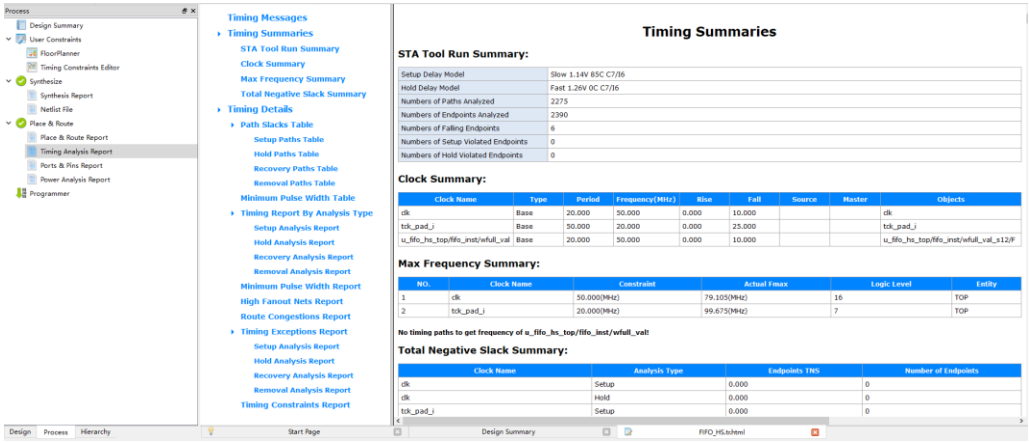
3.12.3 Timing Report

The timing report includes setup check, hold check, recovery time check, removal time check, min. clock pulse check, max. fan out path, Place & Route congestion report, etc. by default. The timing report also includes the max. frequency report.

Double-click Timing Analysis Report in the Process window to open the timing analysis report for the project, as shown in Figure 3-35.

For the details, please refer to *SUG940, Gowin Design Timing Constraints User Guide*.

Figure 3-35 Timing Report



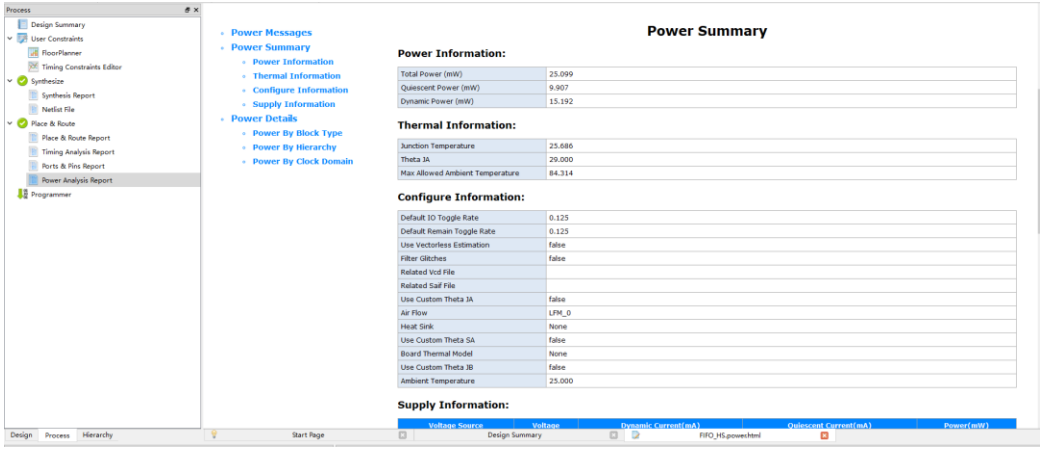
3.12.4 Power Analysis Report

The Power Analysis Report helps you evaluate the basic power consumption of your design.

Double-click Power Analysis Report in the Process window to open the power analysis report as shown in Figure 3-36.

For the details, please refer to chapter 4 Power Analysis Report of *SUG282, Gowin Power Analysis User Guide*.

Figure 3-36 Power Analysis Report

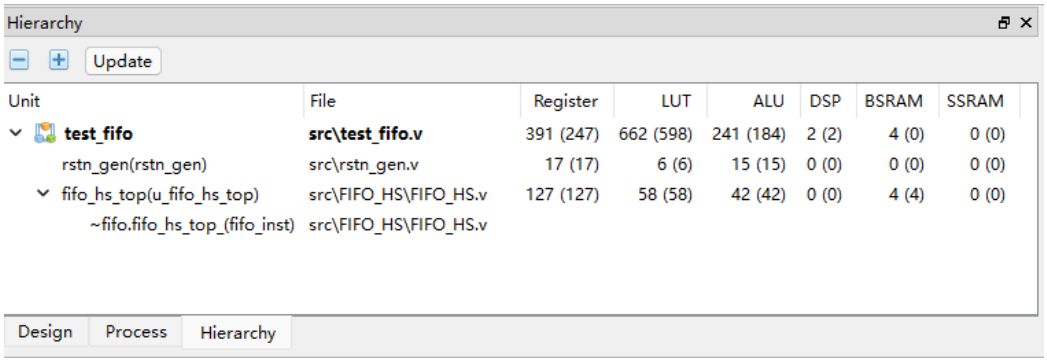


3.13 File Encryption

3.13.1 Source File Encryption

When you need to encrypt and protect source files, you can encrypt the selected module and its sub modules in Hierarchy window, as shown in Figure 3-37. For details, see *SUG100, Gowin Software User Guide*.

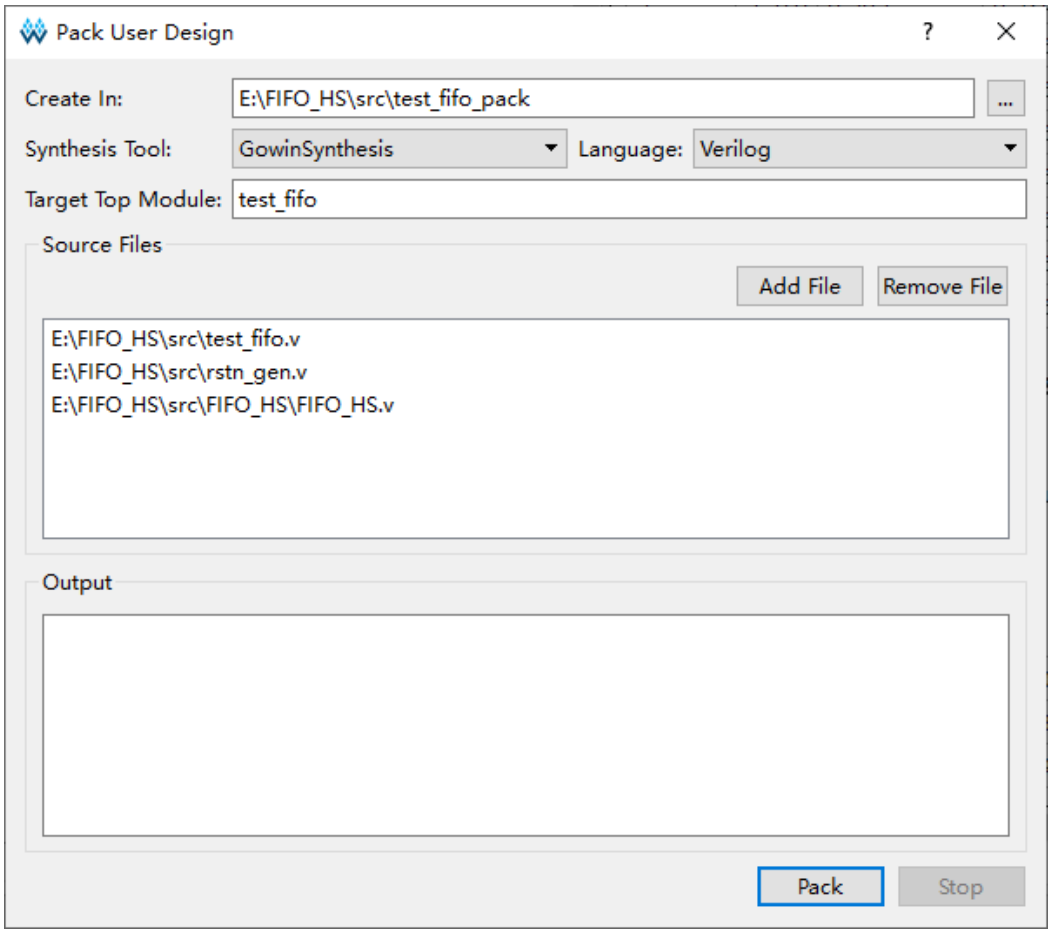
Figure 3-37 Hierarchy Window



Take module module test_fifo as an example to introduce the file encryption.

You can right-click test_fifo in the Hierarchy window and select "Pack User Design" in the right-click list to open the dialog box, as shown in Figure 3-38.

Figure 3-38 Pack User Design Dialog Box



Select test_fifo as the top module. Click "Pack" to start encryption. The relevant information will be printed in the Output window.

After the encryption, two files are generated under the destination path (E:\FIFO_HS\src\test_fifo_pack): test_fifo_gowin.vp and test_fifo_sim.v.

- test_fifo_gowin.vp: Encrypted files that can be used by others.
- test_fifo_sim.v: Flattened synthesized plaintext netlist file that can be used for simulation.

3.13.2 Simulation File Encryption

The simulation file provided by Gowin is plaintext. In order to protect the simulation file, it can be encrypted by using a third-party simulation software, such as Modelsim and VCS, and the license of the tool needs to be obtained. Here it uses test_fifo_sim.v as an example to introduce the encryption.

Encryption by Modelsim

When using Modelsim, the steps to encrypt the simulation file are as follows:

1. Add macro `protect and `endprotect before and after the encrypted in the simulation file test_fifo_sim.v.

2. Run command: vlog +protect test_fifo_sim.v.
3. After running the command, test_fifo_sim.vp is generated in the work library, which is the encrypted file of test_fifo_sim.v that can be used for Modelsim simulation.

Encryption by VCS

When using VCS, the steps to encrypt the simulation file are as follows:

1. Add macro `protect128 and `endprotect128 before and after the encrypted in the simulation file test_fifo_sim.v.
2. Run command: vcs +v2k -protect128 test_fifo_sim.v.
3. After running the command, test_fifo_sim.vp is generated under the current path, which is the encrypted file of test_fifo_sim.v that can be used for VCS simulation.

4 Tcl

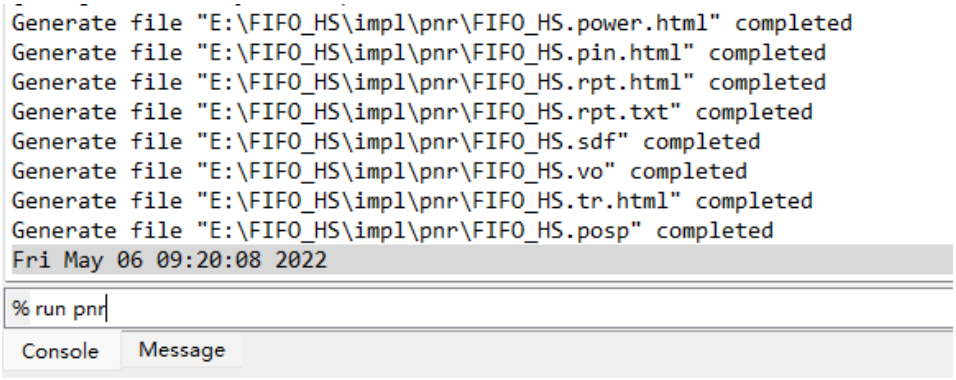
The previous chapters introduce the way to implement the entire design process by using GUI. Gowin Software also provides tcl commands for some settings. Take FIFO HS design in Windows as an example to introduce the usage of tcl commands. For the details, see Chapter 8 Tcl Commands of *SUG100, Gowin Software User Guide*.

4.1 Tcl Execution

4.1.1 Tcl Editing Window

At the bottom of the Console page is the tcl editing window, where you can enter the tcl commands and press Enter to run, as shown in Figure 4-1.

Figure 4-1 Tcl Editing Window

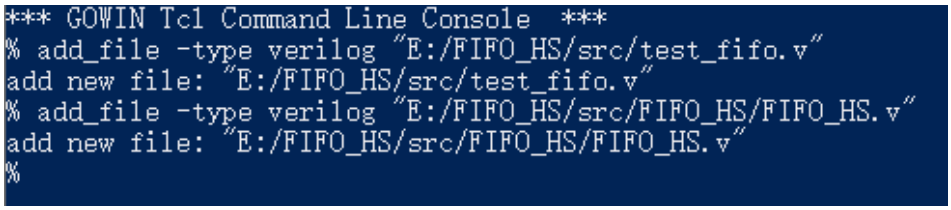


4.1.2 Tcl Command Line

Start command: \x.x\IDE\bin\gw_sh.exe [script file] under the installation directory

The First Way: enter gw_sh.exe to start. This mode executes in the same way as the Tcl editing window, executing tcl commands one by one, as shown in Figure 4-2.

Figure 4-2 Tcl Command Line



The Second Way: use gw_sh.exe [script file] to execute the script file. Tcl script file can contain all the supported tcl commands, such as, device, design file, option, and run information, and tcl script file is shown in Figure 4-3. Tcl script file can be generated by handwriting or saveto command, but saveto command The tcl script file can be generated by hand or by saveto command, but the saveto command does not include the run command when generating the tcl script, so you can add the run command if needed.

Figure 4-3 Tcl Script File

```
1  add_file -type verilog "E:/FIFO_HS/src/FIFO_HS/FIFO_HS.v"
2  add_file -type verilog "E:/FIFO_HS/src/rstn_gen.v"
3  add_file -type verilog "E:/FIFO_HS/src/test_fifo.v"
4  add_file -type cst "E:/FIFO_HS/src/FIFO_HS.cst"
5  add_file -type sdc "E:/FIFO_HS/src/FIFO_HS.sdc"
6  add_file -type gao "E:/FIFO_HS/src/FIFO_HS.rao"
7  add_file -type gpa "E:/FIFO_HS/src/FIFO_HS.gpa"
8  set_device GW1N-LV4LQ144C7/I6 -device_version D
9  set_option -synthesis_tool gowinsynthesis
10 set_option -output_base_name FIFO_HS
11 set_option -top_module test_fifo
12 set_option -verilog_std sysv2017
13 set_option -gen_sdf 1
14 set_option -gen_posp 1
15 set_option -gen_verilog_sim_netlist 1
16 set_option -oreg_in_iob 0
17 set_option -bit_format txt
18 run all
```

4.2 Tcl Quick Start

As tcl command line executes in the same way as the Tcl editing window, the following uses tcl editing window as an example to introduce how to use it.

4.2.1 create_project

create_project is used to create a new project. -name is used to specify the name of the project to be created; -dir is used to specify the path where the project will be located; -pn is used to specify the Part Number, and -device_version is used to specify the version of the device corresponding to the Part Number. The tcl command is implemented as follows:

create_project -name FIFO_HS_newPrj -dir D:/tcl_prj -pn GW1N-LV4LQ144C7/I6 -device_version D

After executing this command, the project named FIFO_HS_newPrj with the device information GW1N-LV4LQ144C7/I6 will be created under the specified path and the project interface will pop up.

4.2.2 import_files

import_files is used to copy files or directories to the current project path/src. -file is used to add one or more files to the project path/src. -fileList is used to specify a list file to be added to the project path under /src, and each line in the file represents a project file to be added. The tcl command is implemented as follows:

import_files -fileList fileList.txt; the contents of the fileList.txt file are:

E:/FIFO_HS/src/FIFO_HS.cst

E:/FIFO_HS/src/FIFO_HS.gpa

E:/FIFO_HS/src/FIFO_HS.rao

E:/FIFO_HS/src/FIFO_HS.sdc

E:/FIFO_HS/src/rstn_gen.v

E:/FIFO_HS/src/test_fifo.v

E:/FIFO_HS/src/FIFO_HS/FIFO_HS.v

After executing this command, it will copy the files in the fileList list to the current project path /src and add all the files under the path to the project.

4.2.3 rm_file

rm_file is used to remove files. For example, use this tcl command to remove rstn_gen.v and test_fifo.v from the project. Use the tcl command to achieve the following:

Remove rstn_gen.v and test_fifo.v

rm_file src/rstn_gen.v src/test_fifo.v

After running the command, the Console will display the prompt for removing files, and these two files will be removed from the Design window.

4.2.4 add_file

add_file is used to add files. Here it will use tcl to add the removed files rstn_gen.v and test_fifo.v to the project. Use the tcl command to achieve the following:

Add rstn_gen.v and test_fifo.v

add_file src/rstn_gen.v src/test_fifo.v

After running the command, the Console will display the prompt for adding files, and these two files will appear in the Design window.

4.2.5 set_file_enable

set_file_enable is used to set whether a file can be used. Here it will use tcl to set test_fifo.v disable/enable.

Modify test_fifo.v to disable

set_file_enable src/test_fifo.v false

After running the command, the Console will display the prompt for disabling the file and test_fifo.v file is grayed out in Design window.

Modify test_fifo.v to enable

set_file_enable src/test_fifo.v true

After running the command, the Console will display the prompt for enabling the file and test_fifo.v file is available in Design window.

4.2.6 set_option

set_option is used to set options in the project. Here it will use tcl to configure synthesis and PnR.

- Select GowinSynthesis

  set_option -synthesis_tool gowinsynthesis

- Set TOP Module/Entity to test_fifo

  set_option -top_module test_fifo

- Set Generate SDF File to True

  set_option -gen_sdf 1

- Set Generate Post-Place File to True

  set_option -gen_posp 1

- Set Generate Post-PNR Verilog Simulation Model File to True

  set_option -gen_verilog_sim_netlist 1

- Set Place output register to IOB to False

  set_option -oreg_in_iob 0

4.2.7 run

Run is used to run a flow or all flows. Here it will use tcl to run synthesis and PnR flows.

- Run synthesis
  Run syn

- Run PnR

  Run pnr

4.2.8 set_device

Set_device is used to set the target device. Here it will use tcl to set GW1N-9 (C version), GW1N-LV9PG256C6/I5 as the target device.

Set GW1N-9 (C version), GW1N-LV9PG256C6/I5 as the target device.

Set_device GW1N-LV9PG256C6/I5 -device_version C

After running the command, the Console will display the device information.

4.2.9 saveto

saveto is used to save the current data to the tcl script, including device, design file, and options, but no run information. Save the data as fifo_hs.tcl, and you can run with command line gw_sh.exe fifo_hs.tcl, as shown below.

Save the current data to fifo_hs.tcl

saveto fifo_hs.tcl

After running the command, the fifo_hs.tcl file is generated on the path where the project files are located.

4.2.10 run close

run close is used to close the current project. The tcl command is implemented as follows:

run close

After executing this command, the current project will be closed.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