Gowin PicoRV32 Quick Design

Reference Manual

IPUG915-1.3E,07/16/2021

Disclaimer

GOWINSEMI assumes no liability and provides no warranty (either expressed or implied) and is not responsible for any damage incurred to your hardware, software, data, or property resulting from usage of the materials or intellectual property except as outlined in the GOWINSEMI Terms and Conditions of Sale. All information in this document should be treated as preliminary. GOWINSEMI may make changes to this document at any time without prior notice. Anyone relying on this documentation should contact GOWINSEMI for the current documentation and errata.

Revision History

Date	Version	Description
01/16/2020	1.0E	Initial version published.
03/13/2020	1.1E	● MCU supports GPIO of Wishbone bus interface; ● MCU supports extended AHB bus interface; ● MCU supports off-chip SPI-Flash download and startup; ● MCU supports the read, write and erasure SPI-Flash; ● MCU supports Hardware Stack Protection and Trap Stack Overflow.
06/01/2020	1.2E	● MCU software online debugging function supported; ● MCU core interrupt handling function enhanced; ● MCU core instructions optimized.
07/16/2021	1.3E	● The synthesis tool, SynplifyPro, deleted; ● FPGA software version updated.

Contents

Contents i
List of Figures ii
List of Tables iii
1 Reference Design 1
1.1 Software reference design 1
1.2 Hardware Reference Design 1
2 Software Reference Design 2
2.1 Software Environment 2
2.2 Import Software Reference Design 2
2.3 Software Configuration 2
2.3.1 Boot Mode Configuration 3
2.3.2 Flash linker Configuration 3
2.4 Build 4
2.5 Download 4
2.6 Reference Manual 5
3 Hardware Reference Design 6
3.1 Hardware Environment 6
3.2 Software Environment 6
3.3 Import Hardware Reference Design 6
3.4 Synthesize 7
3.5 Place & Route 7
3.6 Download 8
3.7 Reference Manual 9

List of Figures

Figure 2-1 Import Software Reference Design 2
Figure 2-2 Boot Mode Configuration 3
Figure 2-3 FLASH Linker Configuration 3
Figure 2-4 Build 4
Figure 2-5 Open Download Tool “Programmer” 4
Figure 3-1 Import Hardware Reference Design 6
Figure 3-2 Synthesis Hardware Reference Design 7
Figure 3-3 Place & Route 7
Figure 3-4 Device Configuration 8

List of Tables

Table 3-1 Hardware Reference Design Examples 7

1 Reference Design

1.1 Software reference design

Gowin_PicoRV32 provides software programming reference design in Gowin MCU Designer (V1.1 and above) software environment. The following reference design is given at:
http://cdn.gowinsemi.com.cn/Gowin_PicoRV32.zip

Gowin_PicoRV32\ref_design\MCU_RefDesign\GMD_RefDesign\gowin_picorv32

1.2 Hardware Reference Design

Gowin_PicoRV32 provides hardware reference design in Gowin Software (V1.9.8 Beta and above). The following reference design is given at: http://cdn.gowinsemi.com.cn/Gowin_PicoRV32.zip

Gowin_PicoRV32\ref_design\FPGA_RefDesign\DK_START_GW2A18_V2.0\gowin_picorv32

2 Software Reference Design

2.1 Software Environment

GOWIN MCU Designer (V1.1 and above) is given at: http://cdn.gowinsemi.com.cn/GMD_V1.1.zip

Note!

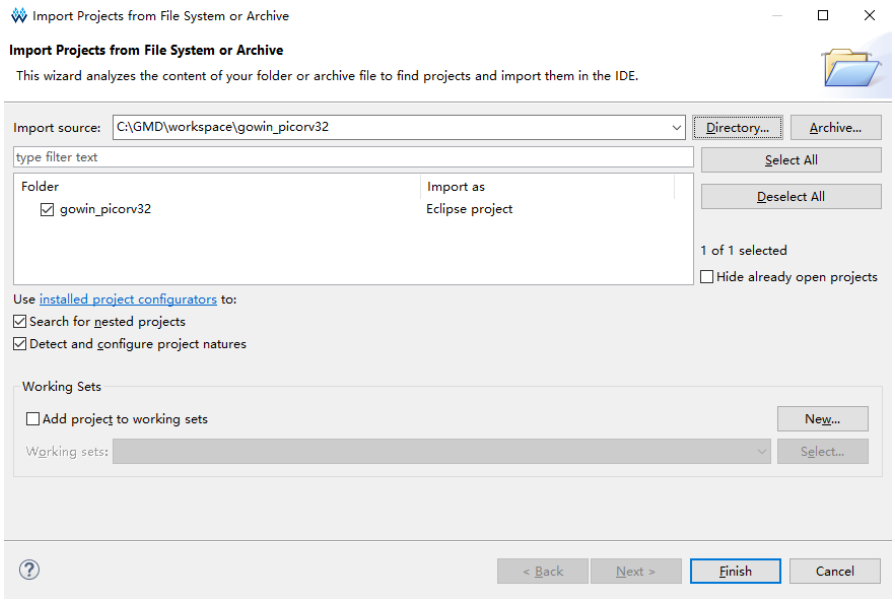
Need a separate license of Gowin MCU Designer and request it to Gowin Technical Support.

2.2 Import Software Reference Design

Take reference design in SDK for an instance.

Double click to open GOWIN MCU Designer and select "File > Open Projects from File System..." in the menu bar. Import the software programming reference design gowin_picorv32click and click "Finish", as shown in Figure 2-1.

Figure 2-1 Import Software Reference Design



2.3 Software Configuration

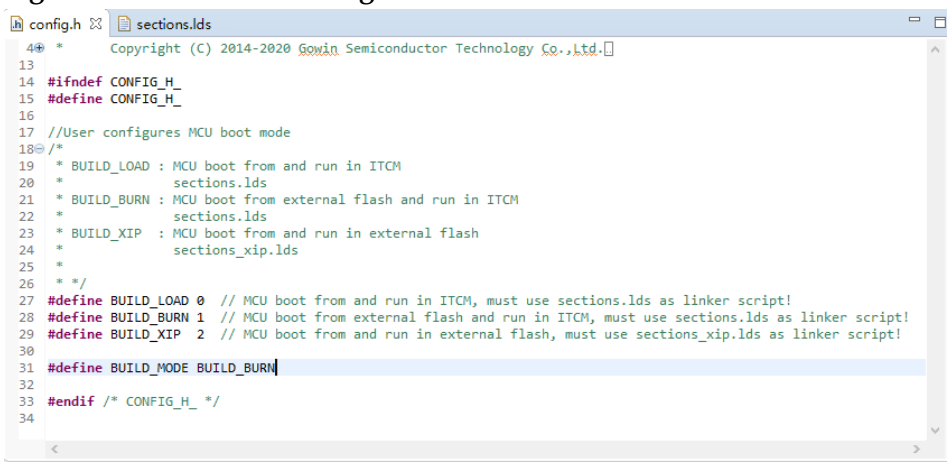
Take reference design in SDK for an instance.

In the ITCM configuration of gowin_picorv32, configure the start-up and run mode as MCU boot fromand run in external Flash and run in ITCM.

2.3.1 Boot Mode Configuration

As having configured the start-up and run mode as “MCU boot from external Flash and run in ITCM” in hardware design, define BUILD_MODE BUILD_BURN in config.h of gowin_picorv32 software design, as shown in Figure 2-2.

Figure 2-2 Boot Mode Configuration

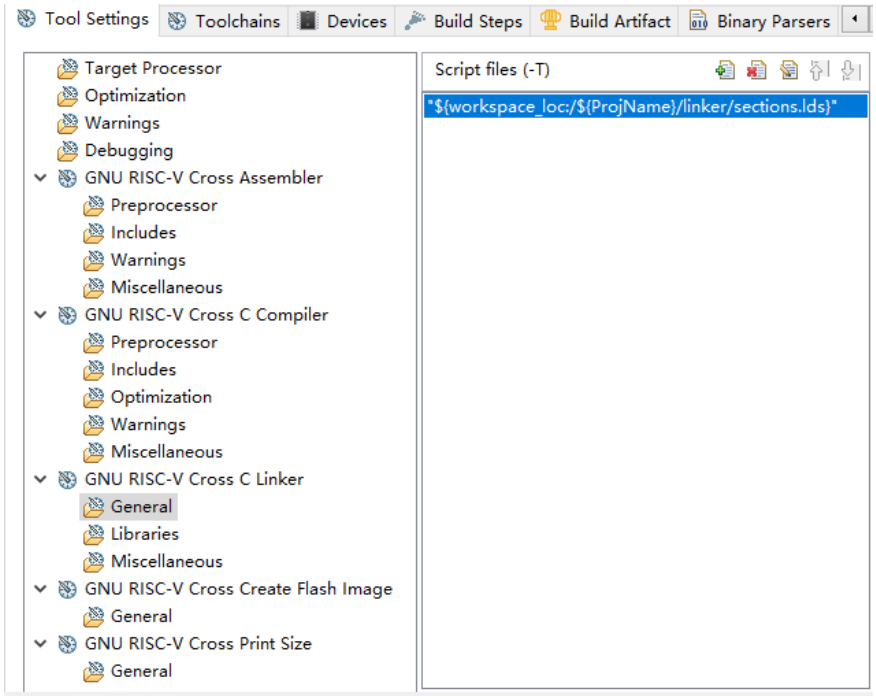


2.3.2 Flash linker Configuration

As having configured the start-up and run mode as MCU boot from external Flash and run in ITCM in hardware design, configure sections_xip.lds as Flash linker in “GNU RISC-V Cross C Linker > General > Script files (-T)”.

The Flash linker configuration is as shown in Figure 2-3.

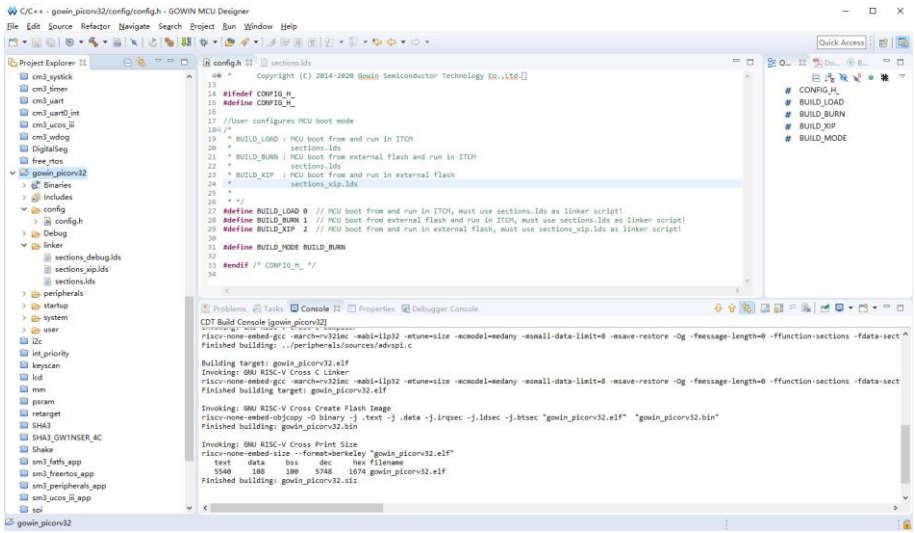
Figure 2-3 FLASH Linker Configuration



2.4 Build

Click the "" compile button to compile the software reference design and generate the software design BIN file, as shown in Figure 2-4.

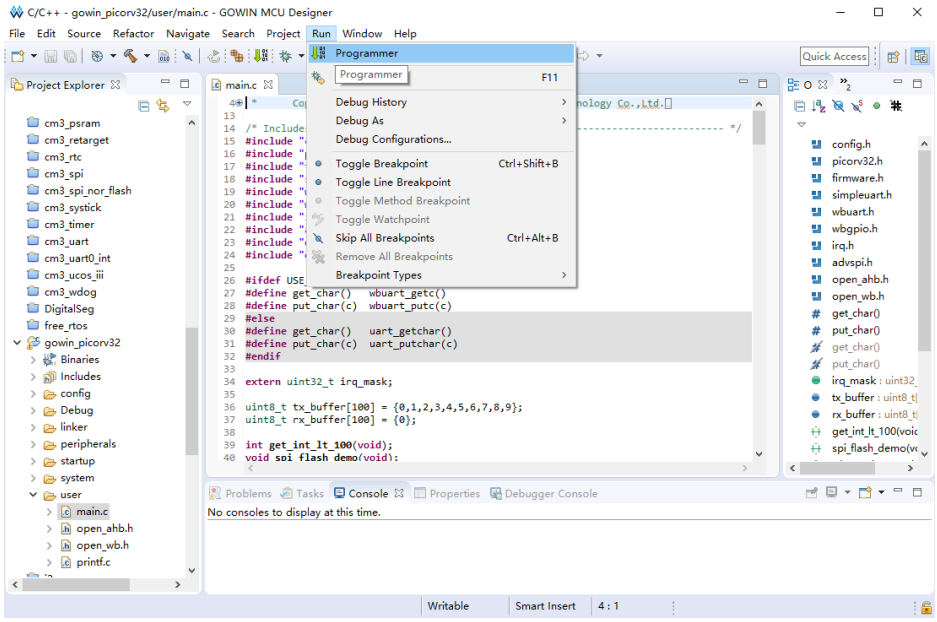
Figure 2-4 Build



2.5 Download

Click "Run/Programmer" in the menu bar or "Programmer" () in the tool bar to open the download tool “Programmer”, as shown in Figure 2-5.

Figure 2-5 Open Download Tool “Programmer”



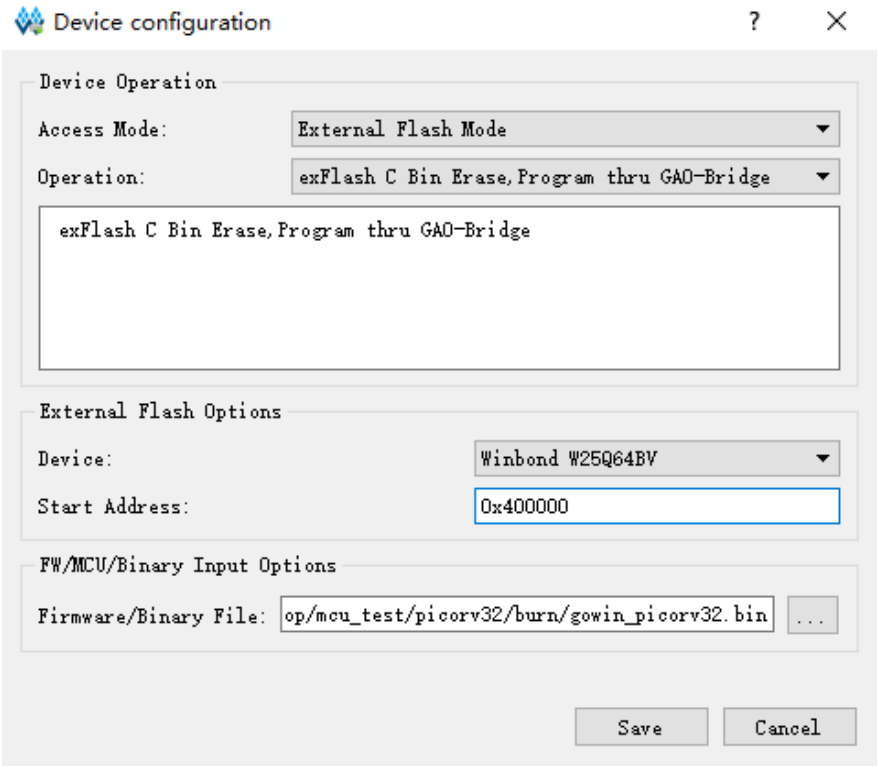
Click "Edit > Configure Device" in the Programmer menu bar or "Configure Device" () in the toolbar to open the "Device configuration".

- Select "External Flash Mode" from the "Access Mode" drop-down list.
- Select "exFlash C Bin Erase, Program thru GAO-Bridge " or “exFlash C Bin Erase, Program, Verify thru GAO-Bridge” from the "Operation"

drop-down list.

- Import the software design BIN file required in " FW/MCU/Binary Input Options > Firmware/Binary File".
- Select " External Flash Options > Device " according to the on-board Flash type, such as on-board Winbond W25Q64BV of Gowin DK-START-GW2A18 V2.0.
- Configure " External Flash Options > Start Address " as "0x400000".
- Click "Save", as shown in Figure 2-6.

Figure 2-6 Device Configuration



After device configuration, click "Program/Configure" ( ) in the Programmer toolbar to complete software design BIN file downloading.

2.6 Reference Manual

For Gowin_PicoRV32 Software Design method, please refer to the following manuals:

- IPUG911, Gowin_PicoRV32 Software Programming Reference Manual
- IPUG910, Gowin_PicoRV32 IDE Software Reference Manual
- IPUG913, Gowin_PicoRV32 Software Programming Reference Manual
- SUG502, Gowin Programmer User Guide.

3 Hardware Reference Design

3.1 Hardware Environment

DK-START-GW2A18 V2.0: GW2A-LV18PG256C8/I7

3.2 Software Environment

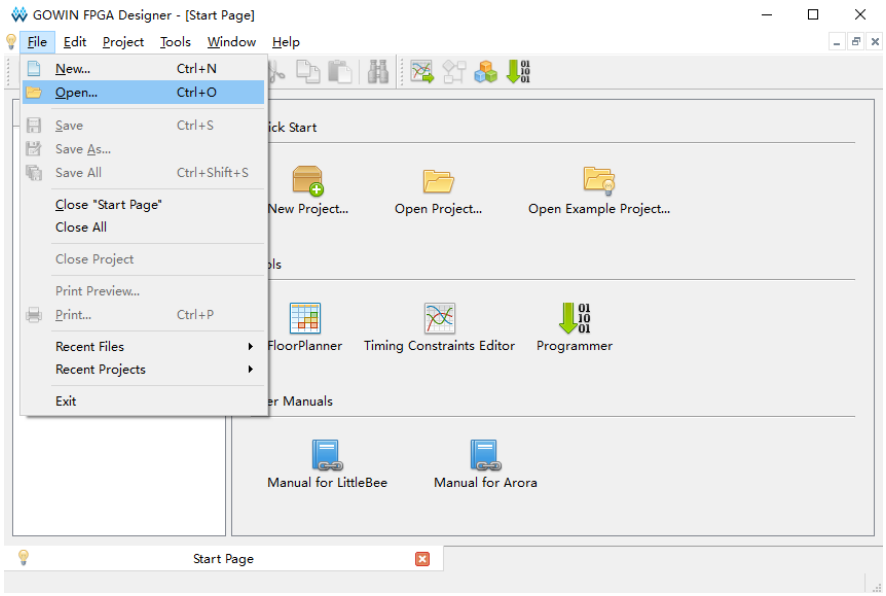
Gowin_V1.9.8 Beta and above

3.3 Import Hardware Reference Design

Take reference design in SDK for an instance.

Double click to open Gowin software, select "File > Open…" to open gowin_picorv32, as shown in Figure 3-1.

Figure 3-1 Import Hardware Reference Design



The description of RTL design files of the hardware reference design project is shown in Table 3-1.

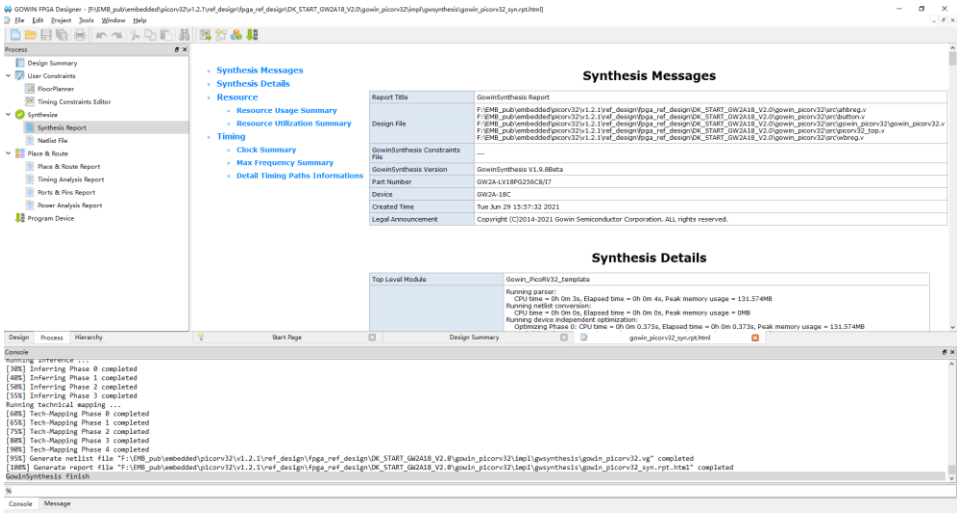
Table 3-1 Hardware Reference Design Examples

File	Description
gowin_picorv32.v	Gowin_PicoRV32 hardware design generated by IP Core Generator
picorv32_top.v	Gowin_PicoRV32 Top Module instantiation and user design
wbreg.v	Open Wishbone bus extension peripheral example
ahbreg.v	Open AHB bus extension peripheral example
button.v	External interrupt example
picorv32.cst	Physical Constraints

3.4 Synthesize

Run the GowinSynthesis® and integrate hardware reference design to generate the netlist file, as shown in Figure 3-2.

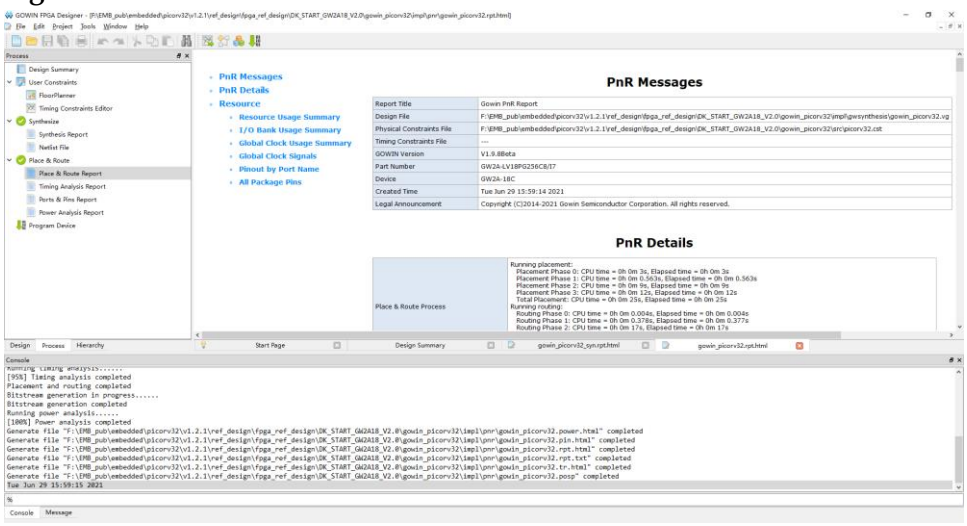
Figure 3-2 Synthesis Hardware Reference Design



3.5 Place & Route

Run Place & Route tool to complete the place & route and generate bitstream files, as shown in Figure 3-3.

Figure 3-3 Place & Route



3.6 Download

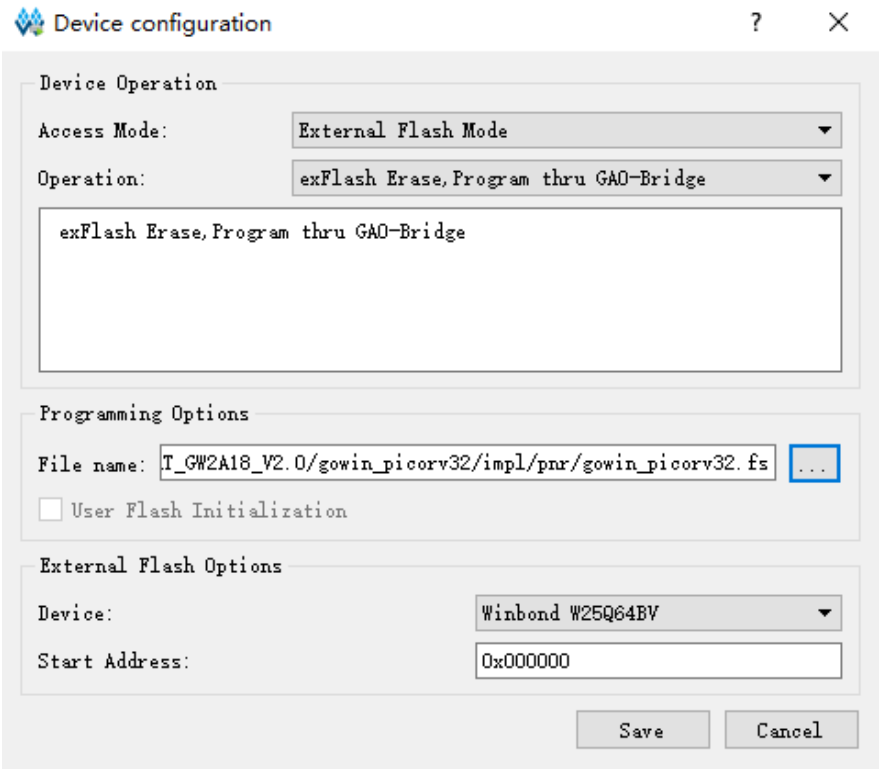
Run the Gowin Software "Programmer" download tool to download the hardware bitstream file.

Click "Edit > Configure Device" in the Programmer menu bar or "Configure Device" ( ) in the toolbar to open the "Device configuration".

Take reference design in SDK DK_START_GW2A18_V2.0 for an instance.

- Select "External Flash Mode" from the "Access Mode" drop-down list.
- Select "exFlash Erase, Program thru GAO-Bridge" or “exFlash Erase, Program, Verify thru GAO-Bridge” from the "Operation" drop-down list.
- Import the file required in "Programming Options > File name ".
- Select " External Flash Options > Device " according to the on-board Flash type, such as on-board Winbond W25Q64BV of Gowin DK-START-GW2A18 V2.0.
- Configure " External Flash Options > Start Address” as "0x000000".
- Click "Save", as shown in Figure 3-4.

Figure 3-4 Device Configuration



After device configuration, click "Program/Configure" ( ) in the Programmer toolbar to complete hardware design bitstream files downloading.

3.7 Reference Manual

Please refer to the following manuals for Gowin_PicoRV32 hardware design:

- IPUG914, Gowin PicoRV32 Hardware Design Reference Manual
- SUG100, Gowin Software User Guide_
- SUG101, Gowin Design Constraints Guide
- SUG502, Gowin Programmer User Guide


GOWIN
PROGRAMMING FOR THE FUTURE