



Gowin USB Programming Download Cable User Guide

UG112-1.4.1E, 03/14/2025

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Revision History

Date	Version	Description
03/28/2017	1.0E	Initial version published.
07/15/2022	1.1E	The descriptions of PL-U2X-Cable added.
07/21/2022	1.1.1E	Figure 2-4 Download Cable Functional Block Diagram updated.
07/20/2023	1.2E	The functions of download cable driver updated.
10/31/2023	1.2.1E	“Figure 2-1 The Appearance of PL-USB-Cable” and “Figure 2-2 The Appearance of PL-U2X-Cable” in “2.2 Appearance and Composition” updated.
12/13/2024	1.3E	<ul style="list-style-type: none">● The download cable functional block diagrams in “2.3 Functional Block Diagram” updated.● The “3.1.3 MacOS” and “3.2.3 MacOS” in “3 Download Cable Driver” added.
02/07/2025	1.4E	“2.7 Communication Protocol Connection” added.
03/14/2025	1.4.1E	“Figure 2-11 UART Connection Diagram (Download Cable V4.1)” updated.

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1 About This Guide

1.1 Purpose

This guide includes two parts:

1. The features, functions, and signal definitions of Gowin USB programming download cable.
2. How to install, download, and use Gowin USB programming download cable.

For simplification, Gowin USB programming download cable is hereinafter referred to as the “download cable”.

1.2 Supported Products

The download cable in the guide applies to all Gowin FPGA products.

1.3 Related Documents

The latest user guides are available on the GOWINSEMI Website. You can find the related documents at www.gowinsemi.com:

- [UG290, Gowin FPGA Products Programming and Configuration Guide](#)
- [UG702, GW2AN-18X & 9X Programming and Configuration Guide](#)
- [UG704, Arora V 138K FPGA Product Programming and Configuration Guide](#)
- [UG714, Arora V 25K FPGA Products Programming and Configuration Guide](#)
- [UG718, Arora V 60K FPGA Products Programming and Configuration Guide](#)
- [DS100, GW1N series of FPGA Products Data Sheet](#)

- [DS173, GW1N series of FPGA Products \(Automotive\) Data Sheet](#)
- [UG103, GW1N series of FPGA Products Package and Pinout User Guide](#)
- [DS117, GW1NR series of FPGA Products Data Sheet](#)
- [UG119, GW1NR series of FPGA Products Package & Pinout User Guide](#)
- [DS821, GW1NS series of FPGA Products Datasheet](#)
- [UG823, GW1NS series of FPGA Products Package & Pinout User Guide](#)
- [DS841, GW1NZ series of FPGA Products Datasheet](#)
- [DS845, GW1NZ series of FPGA Products \(Automotive\) Datasheet](#)
- [UG843, GW1NZ series of FPGA Products Package & Pinout User Guide](#)
- [UG846, GW1NZ series of FPGA Products \(Automotive\) Package & Pinout User Guide](#)
- [DS861, GW1NSR Series of FPGA Products Datasheet](#)
- [UG863, GW1NSR series of FPGA Products Package & Pinout User Guide](#)
- [DS881, GW1NSER Series of SecureFPGA Products Datasheet](#)
- [UG884, GW1NSER series of SecureFPGA Package & Pinout User Guide](#)
- [DS891, GW1NRF series of Bluetooth FPGA Products Data Sheet](#)
- [UG893, GW1NRF series of Bluetooth FPGA Products Package & Pinout User Guide](#)
- [DS102, GW2A series of FPGA Products Data Sheet](#)
- [DS208, GW2A series of FPGA Products \(Automotive\) Data Sheet](#)
- [UG111, GW2A series of FPGA Products Package and Pinout User Guide](#)
- [DS226, GW2AR series of FPGA Products Data Sheet](#)
- [UG229, GW2AR series of FPGA Products Package & Pinout User Guide](#)
- [DS961, GW2ANR series of FPGA Products Data Sheet](#)
- [UG963, GW2ANR series of FPGA Products Package & Pinout User](#)

Guide

- [DS971, GW2AN-18X and GW2AN-9X Data Sheet](#)
- [UG973, GW2AN-18X and GW2AN-9X Package & Pinout User Guide](#)
- [DS976, GW2AN-55 Data Sheet](#)
- [UG975, GW2AN-55 Package & Pinout User Guide](#)
- [DS1103, GW5A Series of FPGA Products Data Sheet](#)
- [DS1113, GW5A Series of FPGA Products \(Automotive\) Data Sheet](#)
- [UG1101, GW5A series of FPGA Products Package & Pinout User Guide](#)
- [DS1108, GW5AR Series of FPGA Products Data Sheet](#)
- [UG1109, GW5AR series of FPGA Products Package & Pinout User Guide](#)
- [DS1118, GW5ART Series of FPGA Products Data Sheet](#)
- [UG1233, GW5ART series of FPGA Products Package & Pinout User Guide](#)
- [DS1105, GW5AS Series of FPGA Products Data Sheet](#)
- [UG1106, GW5AS series of FPGA Products Package & Pinout User Guide](#)
- [DS1239, GW5AST Series of FPGA Products Data Sheet](#)
- [UG1102, GW5AST series of FPGA Products Package & Pinout User Guide](#)
- [DS981, GW5AT Series of FPGA Products Data Sheet](#)
- [DS1111, GW5AT series of FPGA Products \(Automotive\) Data Sheet](#)
- [UG983, GW5AT series of FPGA Products Package & Pinout User Guide](#)

1.4 Terminology and Abbreviations

The terminology and abbreviations used in this manual are as shown in Table 1-1.

Table 1-1 Terminology and Abbreviations

Terminology and Abbreviations	Meaning
FPGA	Field Programmable Gate Array
I2C	Inter-Integrated Circuit
JTAG	Joint Test Action Group
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

1.5 Support and Feedback

Gowin Semiconductor provides customers with comprehensive technical support. If you have any questions, comments, or suggestions, please feel free to contact us directly using the information provided below.

Website: www.gowinsemi.com

E-mail: support@gowinsemi.com

2 Introduction

Gowin USB programming download cable is mainly used to download the bit stream file generated by Gowin Software to Gowin FPGA chip or external storage device. Gowin USB programming download cable is available in two versions, including PL-USB-Cable and PL-U2X-Cable.

2.1 Features

- Supports mainstream operating systems such as Windows, Linux, and MacOS
- Supports all series of Gowin FPGA products
- Downloads the bitstream file of the internal SRAM, on-chip Flash, and off-chip Flash via JTAG, SPI, I2C, and UART
- The USB interface supports DC +5V power supply
- The JTAG interface supports 1.2V~3.3V programming download
- The maximum rate of JTAG interface for PL-USB-Cable is up to 30MHz; while the one for PL-U2X-Cable is fixed at 1.33MHz
- PL-USB-Cable V4.1 and later versions support I2C and UART
- PL-U2X-Cable V5.1 and later versions support I2C
- LED power supply, download instructions
- Conforms to RoHS standard

2.2 Appearance and Composition

The appearance of PL-USB-Cable is shown in Figure 2-1.

Figure 2-1 The Appearance of PL-USB-Cable



The appearance of PL-U2X-Cable is shown in Figure 2-2.

Figure 2-2 The Appearance of PL-U2X-Cable

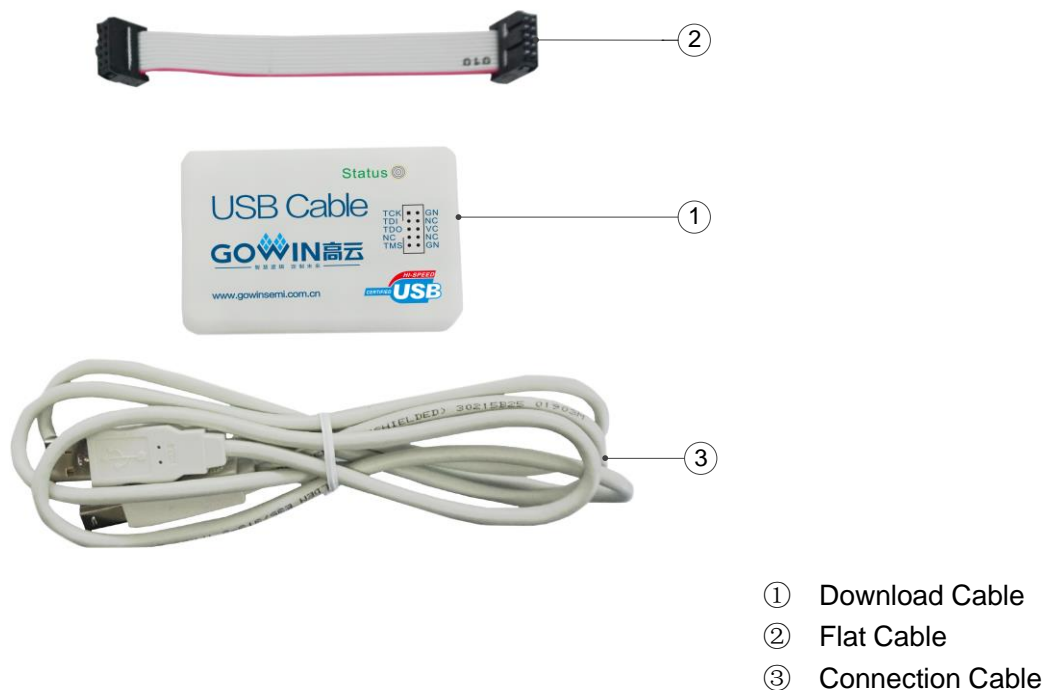


As shown in Figure 2-3, in addition to the download cable ①, a flat cable ②, and a connection cable ③ are also contained in Gowin USB cable Box. The list is as follows:

1. One download cable

2. One 10Pin flat cable
3. One USB-A to USB-B type connection cable

Figure 2-3 Box List

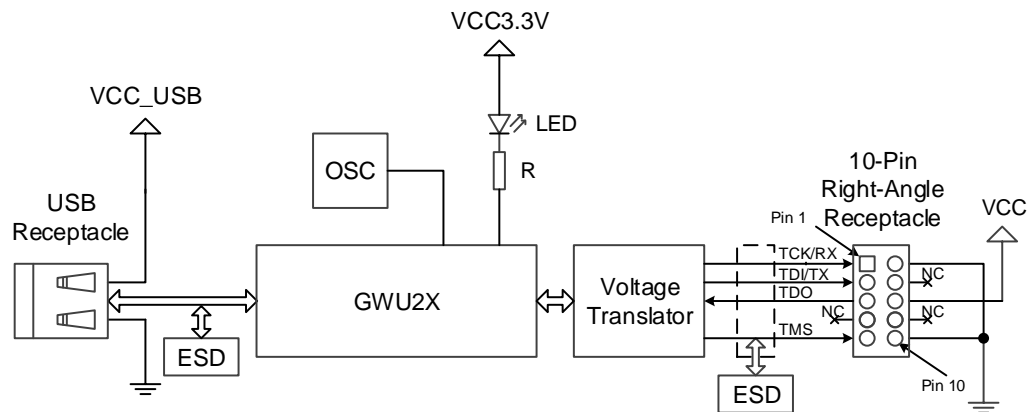


Note!

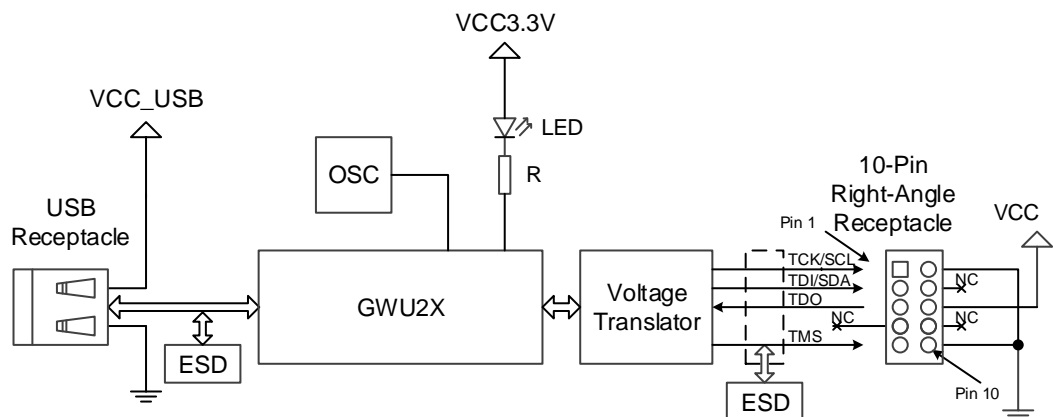
The red line in cable ② is Pin1 (TCK).

2.3 Functional Block Diagram

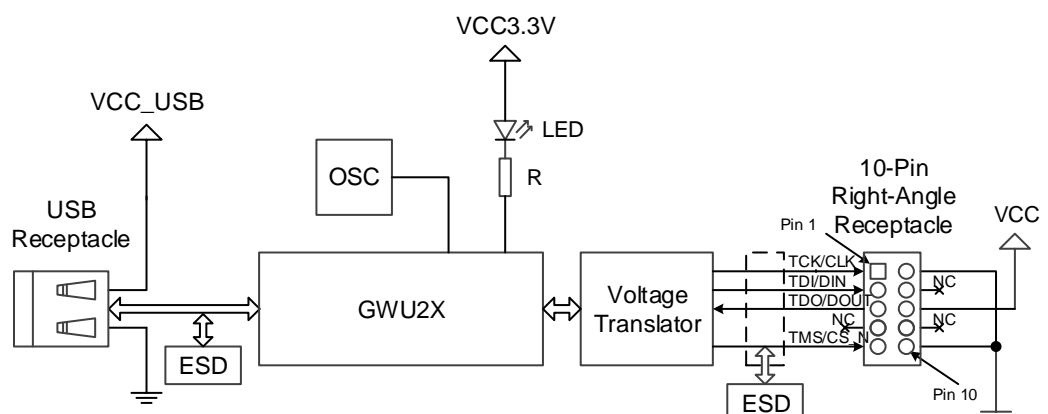
The functional block diagram of the cable mainly includes USB interface socket, ESD, OSC, USB interface circuit. FPGA, LED, level conversion circuit and JTAG socket. The USB download cable supports JTAG download of all series of Gowin FPGA products, downloading bitstream files from FPGA SRAM, on-chip Flash, and off-chip Flash. It also supports Gowin online logic analyzer.

Figure 2-4 Download Cable Functional Block Diagram (JTAG/UART)**Note!**

Only PL-USB-Cable V4.1 and later versions support UART.

Figure 2-5 Download Cable Functional Block Diagram (JTAG/I2C)**Note!**

PL-USB-Cable V4.1 and later versions as well as PL-U2X-Cable V5.1 and later versions support I2C. When using I2C, TDO must be left floating.

Figure 2-6 Download Cable Functional Block Diagram (JTAG/SSPI/SERIAL)

2.4 Signal Definition

Table 2-1 JTAG Interface Signal Definition

Pin No.	Signal Name	I/O	Description
1	TCK	O	Clock signal
2	GND	-	GND
3	TDI	O	Data sent to the device
4	NC	-	-
5	TDO	I	Data received from the device
6	VCC		Input VCC on the device
7	NC	-	-
8	NC	-	-
9	TMS	O	Control signal of state machine
10	GND	-	GND

Table 2-2 Signal Definition of USB Interface

Pin No.	Signal Name	I/O	Description
1	VCC_USB	I	Input power on USB
2	USB_D+	I/O	Differential data on USB interface
3	USB_D-	I/O	Differential data on USB interface
4	GND	-	Power Ground

2.5 AC/DC Characteristic

The limit working parameters of the download cable and the recommended working parameters of VCC are introduced follows. It is recommended to use advised working conditions to ensure reliably operation of the download cable.

Table 2-3 Limit Operating Parameters

Item	Description	Min.	Max.	Unit
VCC	Device-side power supply	-0.3	4.6	V
VCC_USB	USB-side power supply	-0.5	6.0	V
I _o	Output current	-50	50	mA
I _I	Input current	-50	50	mA

Table 2-4 Recommended Operating Parameters Based on VCC

Item	I/O Level	Min.	Max.	Unit
VCC	3.3	3.0	3.6	V
	2.5	2.375	2.625	V
	1.8	1.71	1.89	V
	1.5	1.43	1.57	V
	1.2	1.14	1.26	V

2.6 ESD Features

- Conforms to IEC61000-4-2 standard
- ESD protection $\pm 15\text{kV}$ for contacting discharge and $\pm 8\text{kV}$ for air discharge

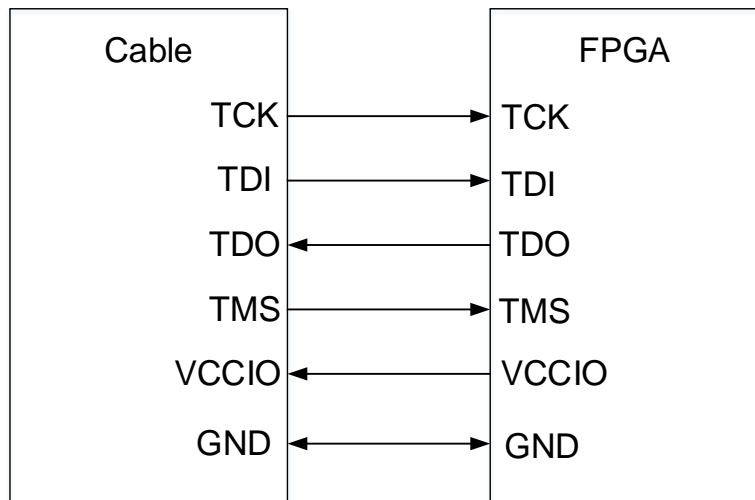
2.7 Communication Protocol Connection

Gowin USB programming download cable supports various communication protocols, including JTAG, SPI, I2C, and UART. Each protocol has a distinct connection method suited for different application scenarios. When using these protocols, users must follow the connection diagrams provided by Gowin to configure the connections correctly. Each protocol has specific requirements for interfaces and signal transmission. Ensuring proper connection in accordance with the guidelines is essential for maintaining system stability and reliability. By selecting the appropriate protocol and adjusting the connections according to the diagrams, users can significantly enhance data transmission efficiency and avoid communication failures or performance issues caused by improper connections.

2.7.1 JTAG Protocol Connection

JTAG (Joint Test Action Group) protocol is a standard protocol used for testing and programming electronic devices, primarily for debugging and programming through a four-wire interface (TDI, TDO, TCK, TMS). It employs serial communication to daisy-chain multiple devices, enabling operations such as hardware testing, debugging, and firmware updates by controlling clock and mode selection signals. JTAG is widely used in FPGA configuration, embedded debugging, and circuit board testing.

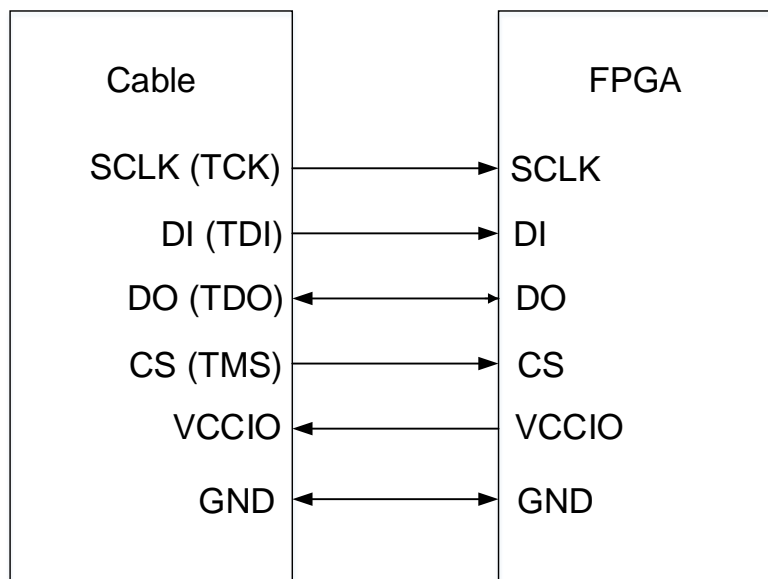
The connection diagram of JTAG protocol is shown in Figure 2-7.

Figure 2-7 JTAG Connection Diagram

2.7.2 SPI Protocol Connection

SPI (Serial Peripheral Interface) is a synchronous serial communication protocol that enables high-speed data transfer between master devices and slave devices through four lines (DI, DO, SCLK, and CS). SPI supports full-duplex communication and features a simple structure, making it ideal for short-distance applications such as high-speed sensor data reading and display control.

The connection diagram of SPI protocol is shown in Figure 2-8.

Figure 2-8 SPI Connection Diagram

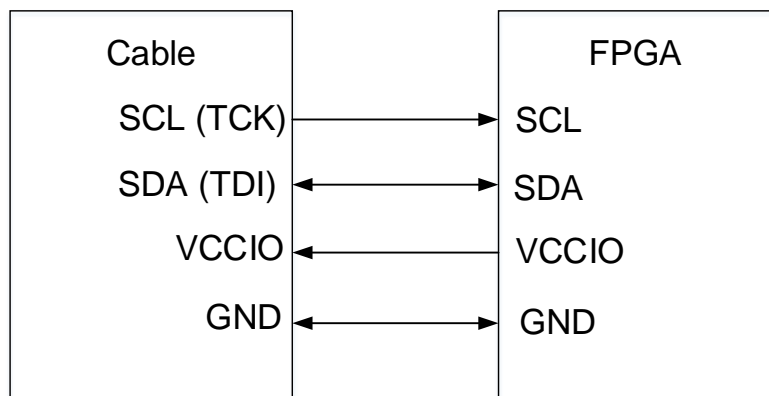
2.7.3 I2C Protocol Connection

I2C (Inter-Integrated Circuit) is a synchronous serial communication protocol that uses two lines, SDA and SCL, to transfer data between master and slave devices. It supports multi-master and multi-slave communication, features a simple structure, and is widely used for data exchange between low-speed devices, such as sensor configuration and memory reading.

In the download cable (V4.1 & V5.1), modifications have been made to the I2C protocol. By controlling the chip pins, the download cables handle the input and output of the SDA line internally. This eliminates the need for manually connecting the two SDA pins (displayed as TDI and TDO on the download cable) externally.

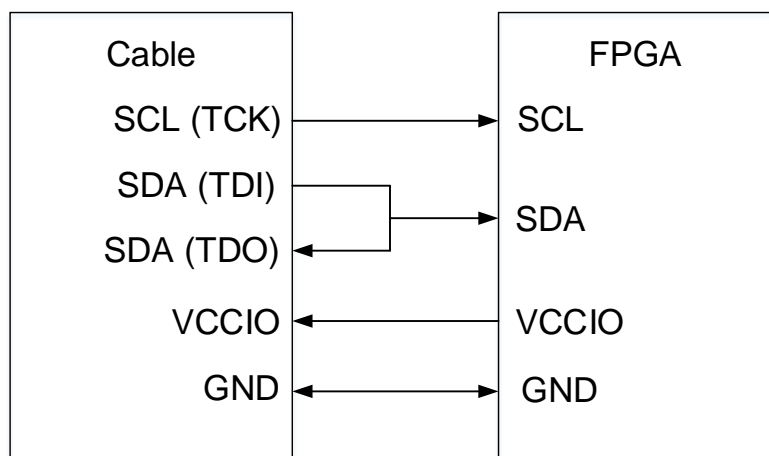
The connection diagram of I2C protocol for the download cables (V4.1 & V5.1) is shown in Figure 2-9.

Figure 2-9 I2C Connection Diagram (Download Cable V4.1 & V5.1)



The connection diagram of I2C protocol for the download cables (V4.0 & V5.0) is shown in Figure 2-10.

Figure 2-10 I2C Connection Diagram (Download Cable V4.0 & V5.0)



2.7.4 UART Protocol Connection

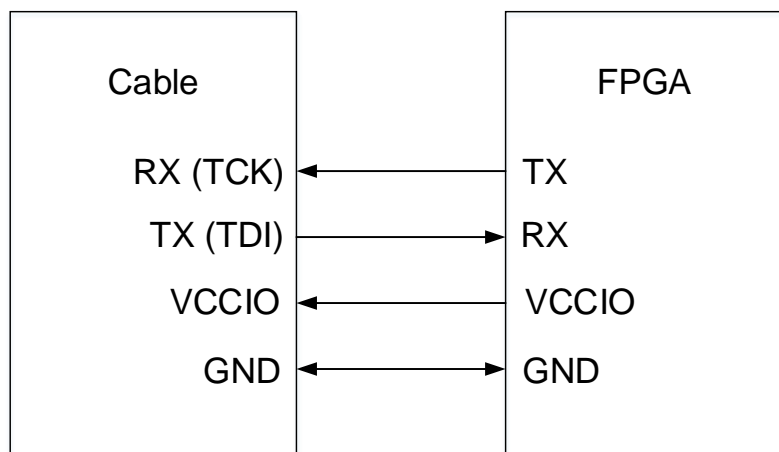
UART (Universal Asynchronous Receiver/Transmitter) is an asynchronous serial communication protocol that transmits and receives data through two lines, TX and RX. It does not require a clock signal, supports longer transmission distances, and is commonly used for embedded device debugging and serial communication.

The download cable (V4.1) has added support for the UART protocol, and the connection diagram is shown in Figure 2-11.

Note!

The download cables (V4.0 & V5.0 & V5.1) do not support UART protocol!

Figure 2-11 UART Connection Diagram (Download Cable V4.1)



3 Download Cable Driver

3.1 PL-USB-Cable Driver

3.1.1 Windows

Before using the download cable, you need to install the programmer on your Windows system. You can download the Gowin Programmer at the Gowin EDA Home of the [Gowin Semiconductor website](#), as shown in Figure 3-1 and Figure 3-2.

Figure 3-1 Gowin Software Page

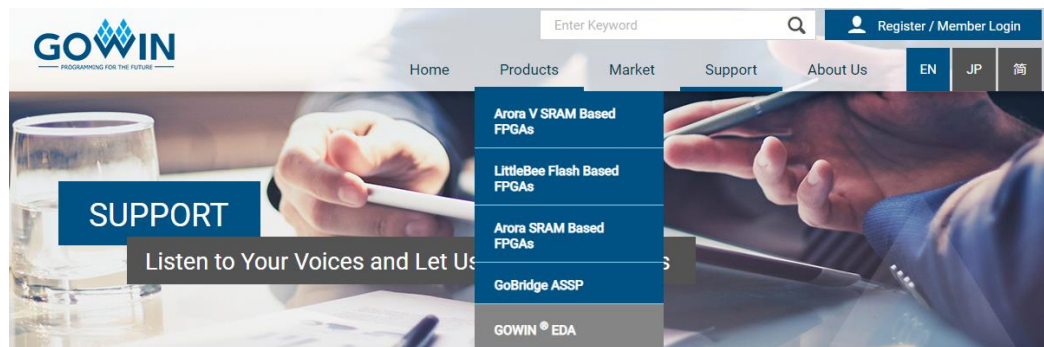
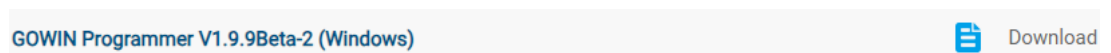


Figure 3-2 Gowin Programmer



1. After the download is complete, you need to manually extract the files. Once the extraction is complete, open the Programmer-driver to access the interface as shown in Figure 3-3. Install the driver program according to your specific system requirements.

Figure 3-3 Setup Interface

软件 (D:) > Programmer_Gowin > programmer > history_py > programmer1.9.9B2(build30223).Win32.x86 > Programmer > driver			
名称	修改日期	类型	大小
GowinUSBCableDriverV4_for_win7+.exe	2018/11/27 21:03	应用程序	2,400 KB
GowinUSBCableDriverV4_for_winXP.exe	2019/2/22 12:18	应用程序	1,703 KB
GowinUSBCableDriverV5_for_win7+.exe	2022/10/24 16:34	应用程序	5,646 KB
vcredist2010_x86.exe	2017/11/6 21:40	应用程序	4,879 KB

2. The installation begins.

Figure 3-4 Start to Unpack Driver Program of Download Cable

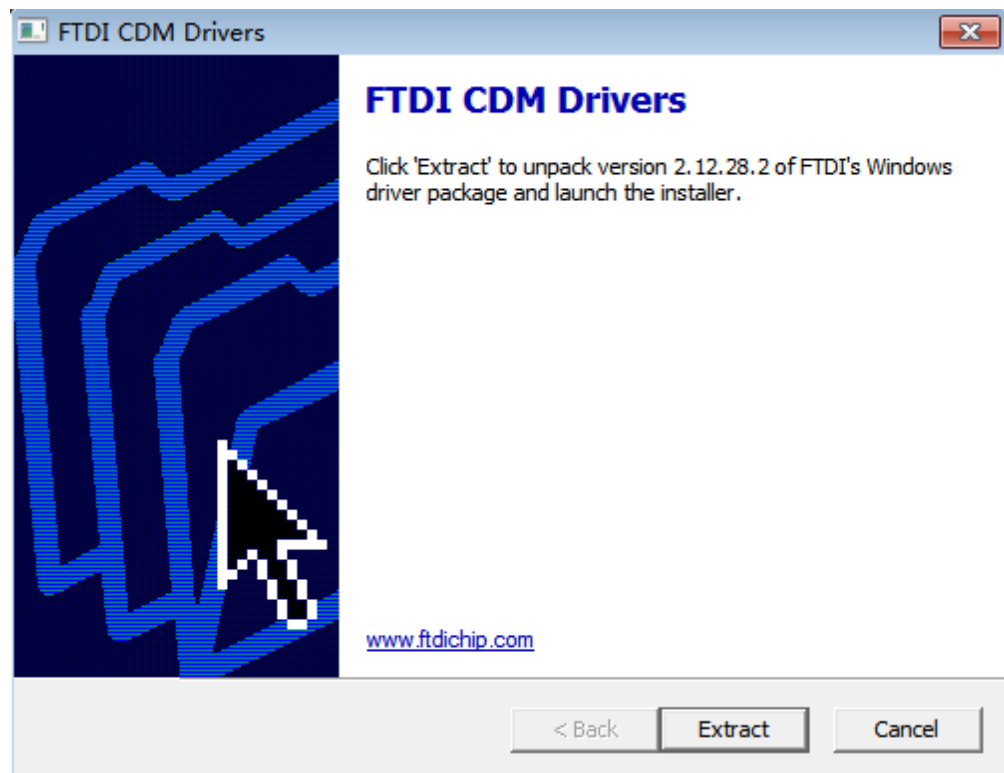
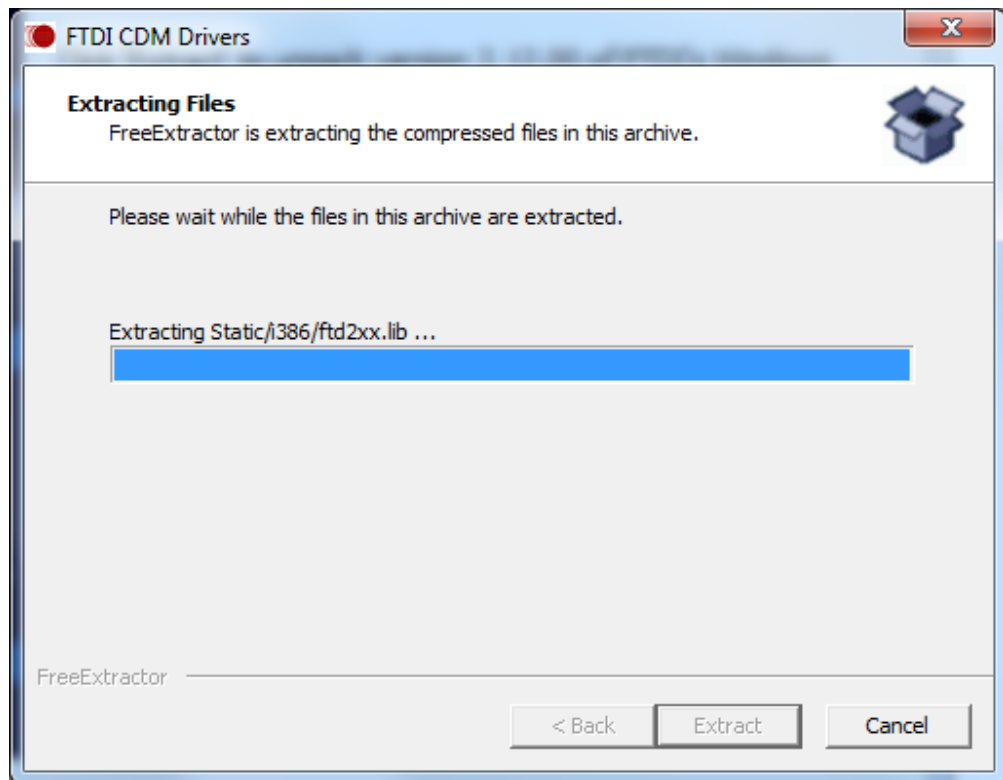
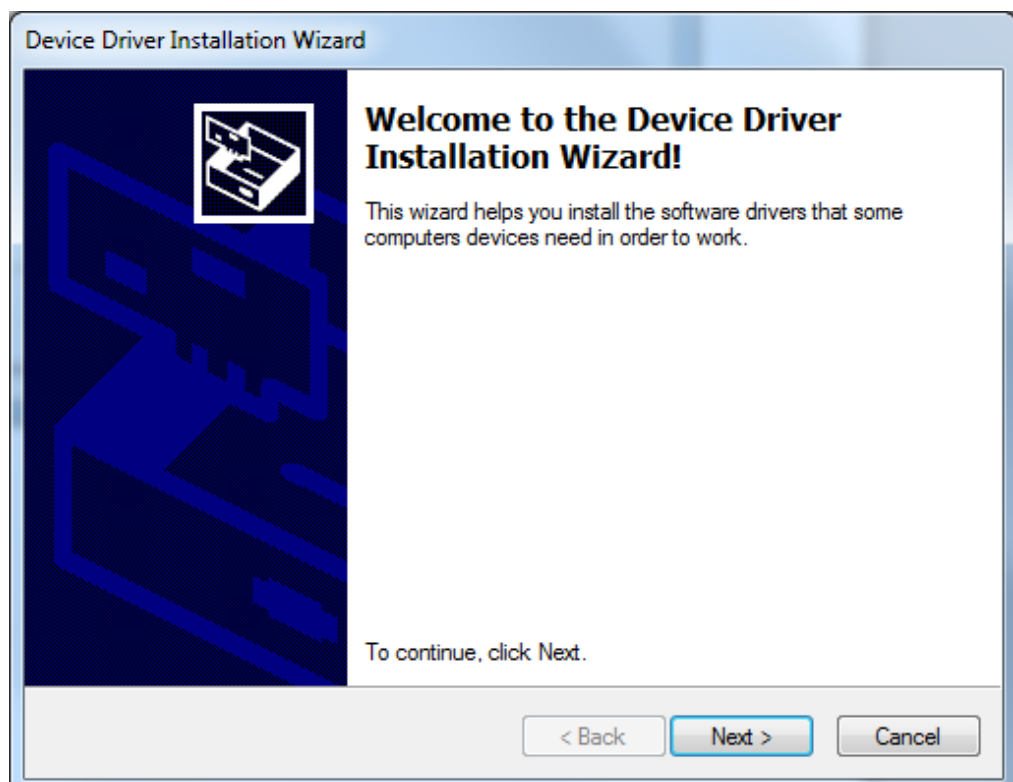


Figure 3-5 Unpacking Driver Program of Download Cable



3. After finishing unpacking, click "Next>" to the next step, as shown in Figure 3-6.

Figure 3-6 Finish Installing Download Cable Driver



4. Select "I accept this agreement" and click "Next>" to install, as shown in Figure 3-7. The download cable driver installation interface is as shown in Figure 3-8.

Figure 3-7 Agreement License

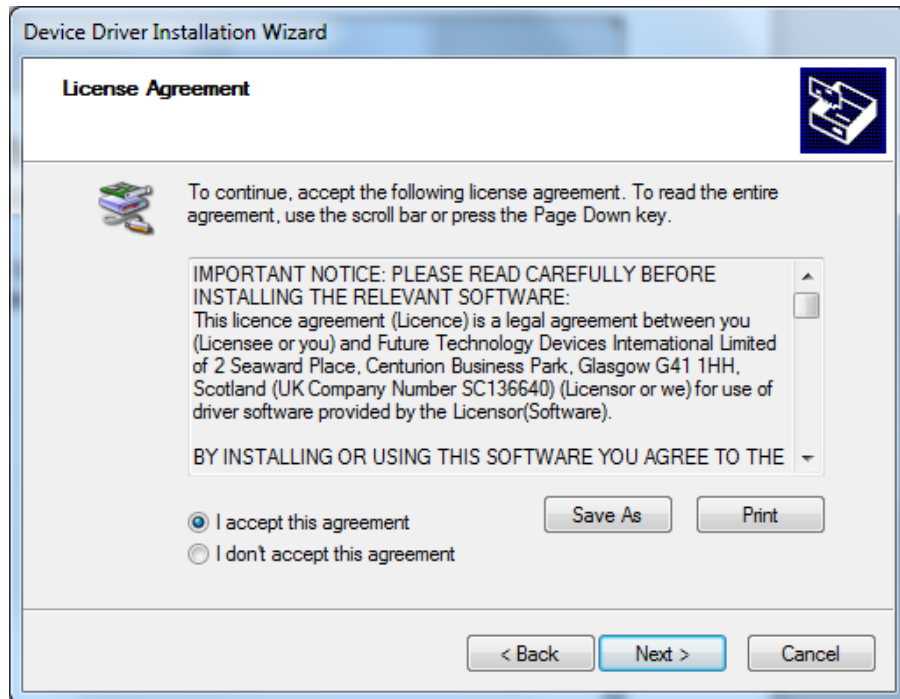
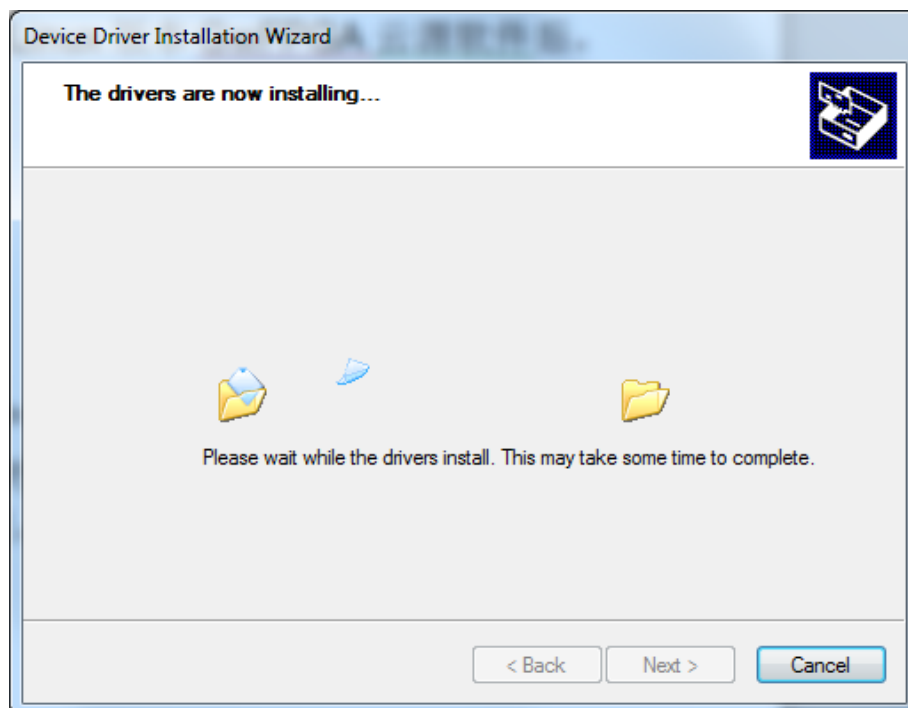
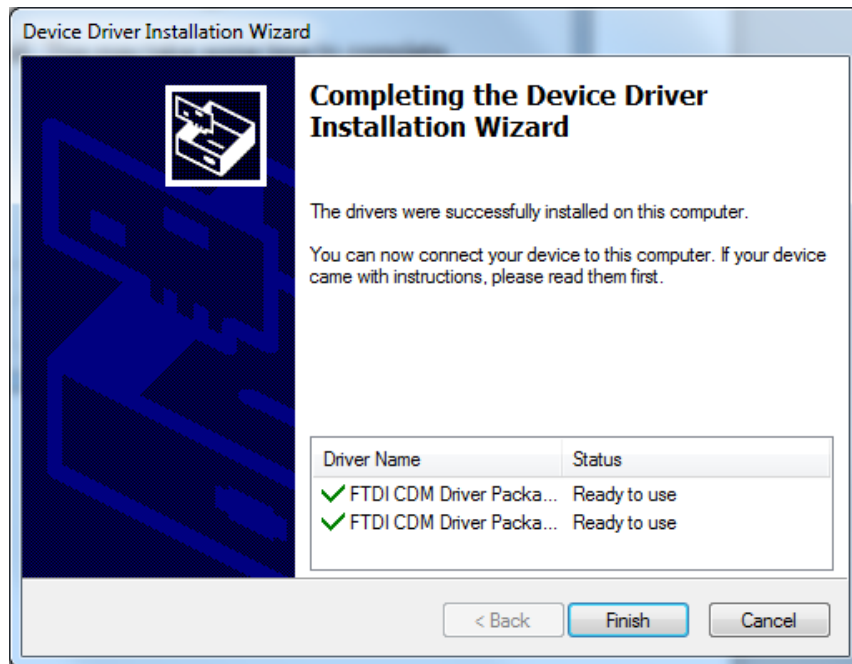


Figure 3-8 Installing Download Cable Driver



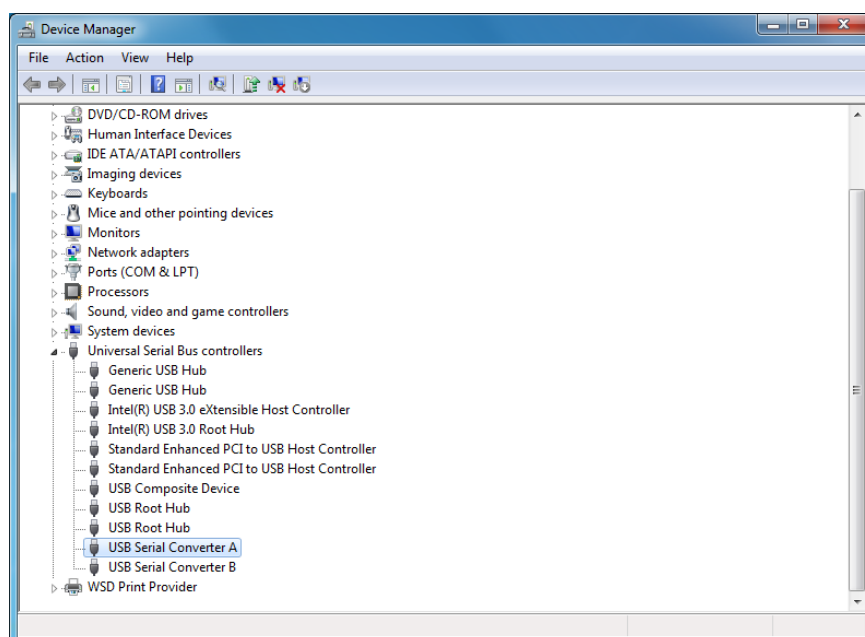
- Click "Finish" to finish installing the download cable driver, as shown in Figure 3-9.

Figure 3-9 Finish Installing Download Cable Driver



- The "USB Serial Converter A" is appeared at the end of the Universal Serial Bus controllers after the USB download cable is connected to the PC, which means that the cable driver is installed successfully and you can download/configure the FPGA through the download cable, as shown in Figure 3-10.

Figure 3-10 Download Cable Driver Interface on PC



7. Go back to the main folder and open Programmer-bin to get the interface as shown in Figure 3-11.

Figure 3-11 Programmer.exe Interface

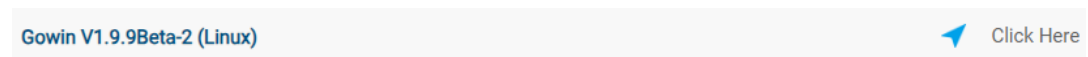
名称	修改日期	类型	大小
api-ms-win-crt-heap-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	22 KB
api-ms-win-crt-locale-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	21 KB
api-ms-win-crt-math-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	29 KB
api-ms-win-crt-process-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	22 KB
api-ms-win-crt-runtime-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	25 KB
api-ms-win-crt-stdio-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	27 KB
api-ms-win-crt-string-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	27 KB
api-ms-win-crt-time-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	23 KB
api-ms-win-crt-utility-l1-1-0.dll	2020/7/6 10:44	应用程序扩展	21 KB
ftd2xx.dll	2023/7/4 11:05	应用程序扩展	199 KB
InfoEditor.exe	2023/7/4 11:05	应用程序	3,337 KB
JTAGLoading.exe	2023/7/4 11:05	应用程序	2,238 KB
jtagserver.exe	2023/7/4 11:05	应用程序	2,366 KB
jtagserver_lpt.exe	2023/7/4 11:05	应用程序	2,262 KB
jtagserver_u2x.exe	2023/7/4 11:05	应用程序	1,511 KB
libusb-1.0.dll	2023/7/4 11:05	应用程序扩展	108 KB
msvcrt100.dll	2023/7/4 11:05	应用程序扩展	412 KB
msvcrt140.dll	2019/3/8 17:13	应用程序扩展	606 KB
msvcrt100.dll	2023/7/4 11:05	应用程序扩展	756 KB
programmer.exe	2023/7/4 11:05	应用程序	9,119 KB
programmer_cli.exe	2023/7/4 11:05	应用程序	8,008 KB
python3.dll	2023/7/4 11:05	应用程序扩展	71 KB

8. Once the PC is connected to the download cable, double-click programmer.exe to configure the FPGA for download via the download cable.

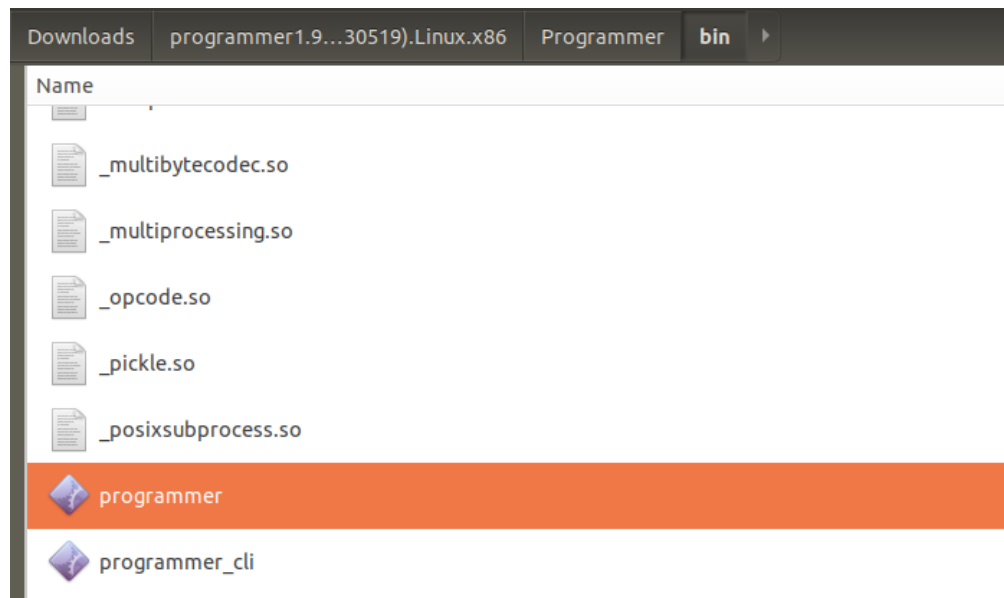
3.1.2 Linux

Similar to Windows system, log in to the [Gowin Semiconductor website](#) and download the Gowin Programmer for Linux system, as shown in Figure 3-12.

Figure 3-12 Linux Version of Gowin Programmer



1. Once the download is complete, you will need to manually extract it, and when the extraction is complete, open Programmer-bin to get the interface as shown in Figure 3-13.

Figure 3-13 Path of Programmer

2. Once the PC is connected to the download cable, open the terminal and enter "sudo programmer" to start the programmer with root privileges and the FPGA can be configured for download via the download cable. Please refer to Chapter 3.3 USB-Cable Permission Configuration on Linux System for detailed instructions on how to modify the cable permissions to enable the programmer tool to be used with regular user permission.

3.1.3 MacOS

The current Gowin IDE and download cable only support operating systems with Apple chip architecture, and the operating system already includes the required drivers.

3.2 PL-U2X-Cable Download Cable Driver

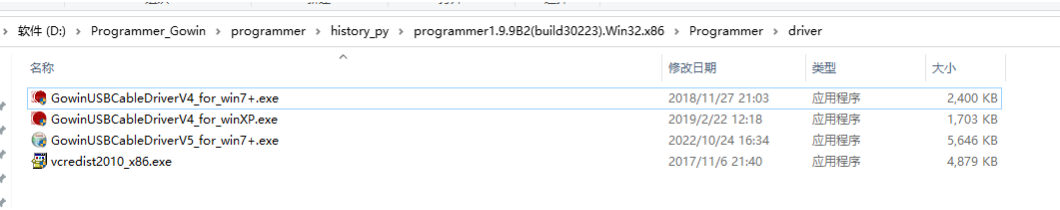
3.2.1 Windows

There are two feasible methods to install PL-U2X-Cable driver on the Windows system, and each method can independently complete the installation. You can choose either one of the methods.

3.2.1.1 Gowin USB Cable Driver

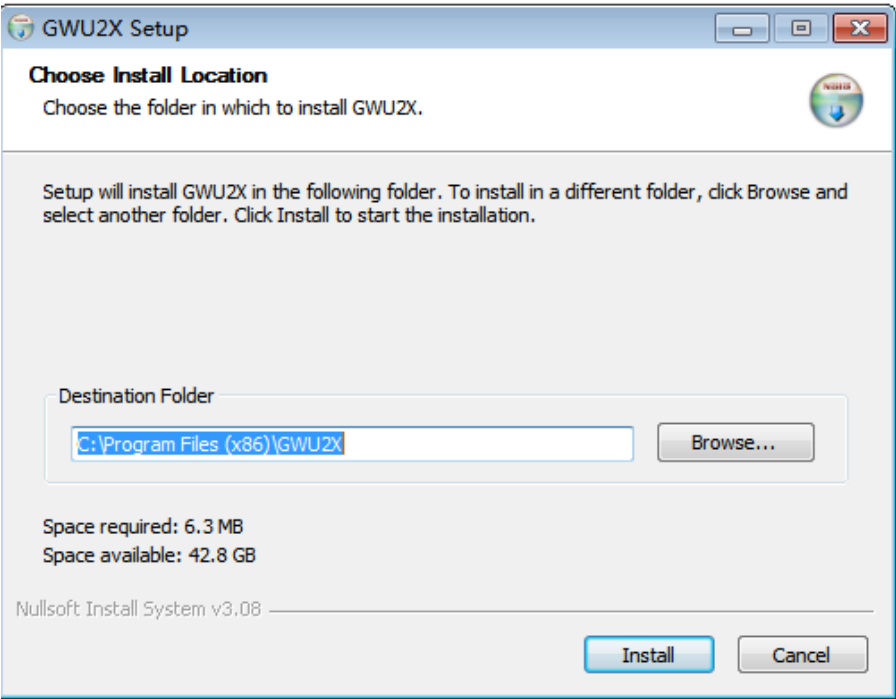
After download the Gowin Programmer from the Gowin Semiconductor website, manually unpack the programmer and open the programmer-driver to get the interface shown in Figure 3-14. Install the driver depending on different systems.

Figure 3-14 Setup Interface



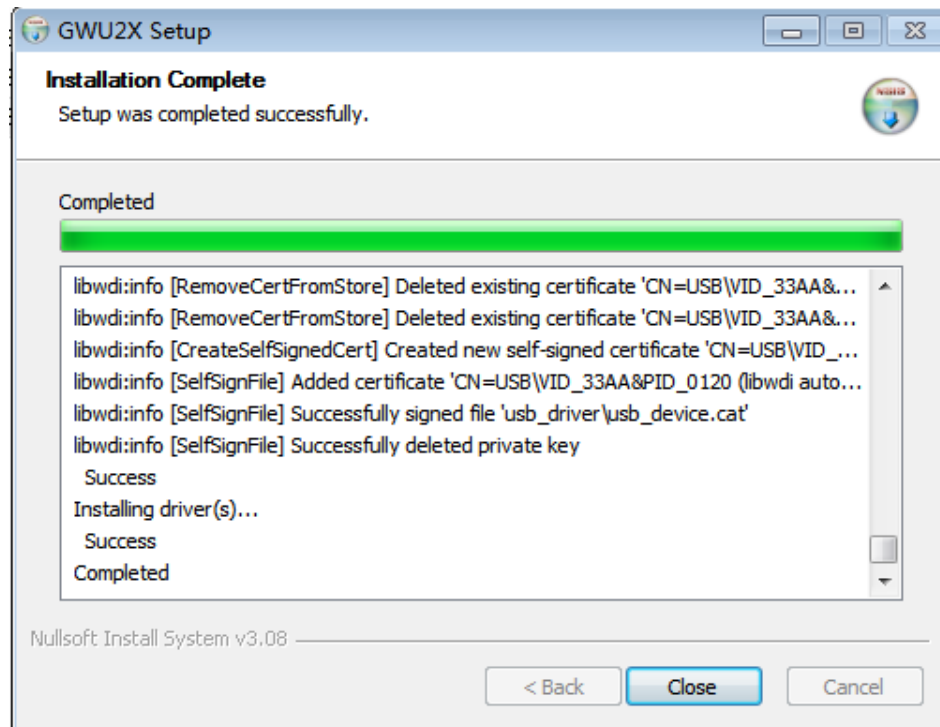
1. Start installation.
Select the driver installation path and click “install” to start the installation, as shown in Figure 3-15.

Figure 3-15 Driver Installation Path Interface



2. Wait for the installation to complete, as shown in Figure 3-16.

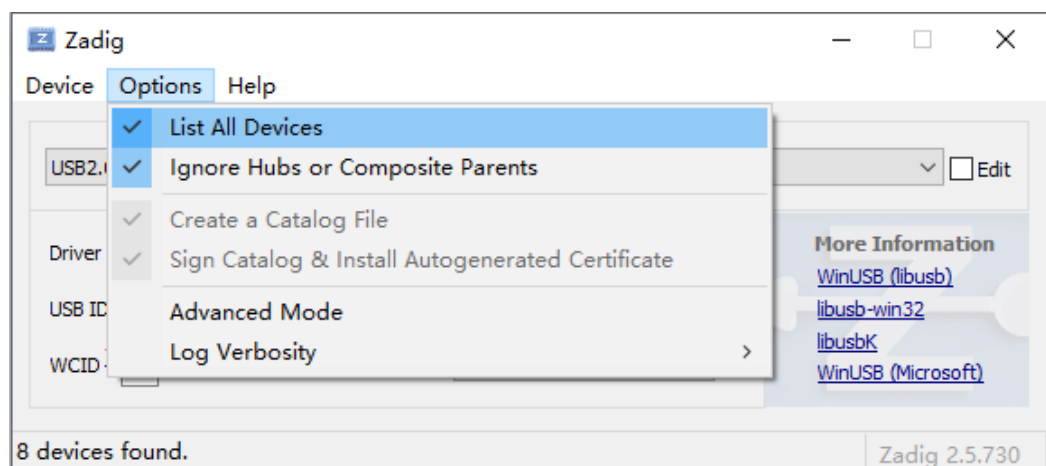
Figure 3-16 Finish Installing Driver



3.2.1.2 Zadig

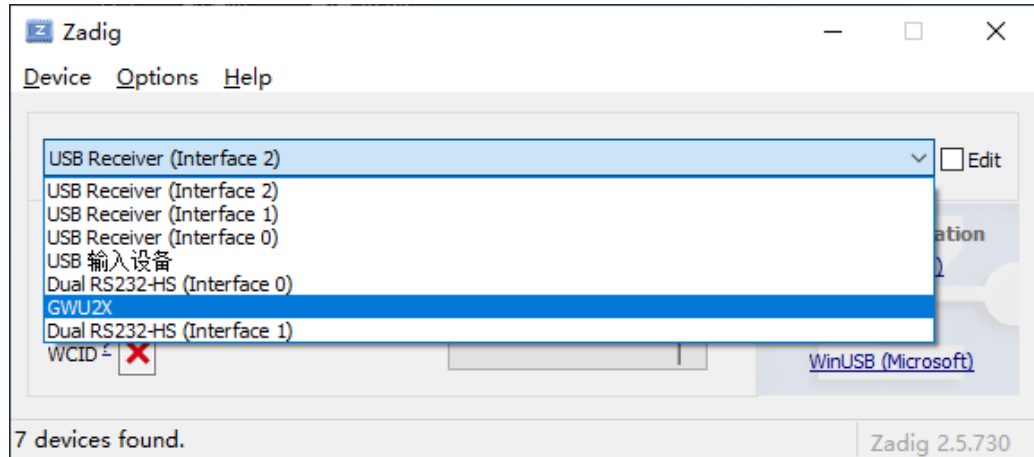
1. Download and save Zadig driver installer:
<https://github.com/pbatard/libwdi/releases/download/v1.4.1/zadig-2.7.exe>.
2. Connect GWU2X device to the computer USB interface, double-click to open Zadig (administrator privileges required), click Options, and check the "List All Device" option. All USB devices connected to the computer will be listed, as show in Figure 3-17.

Figure 3-17 Check "List All Device" Option



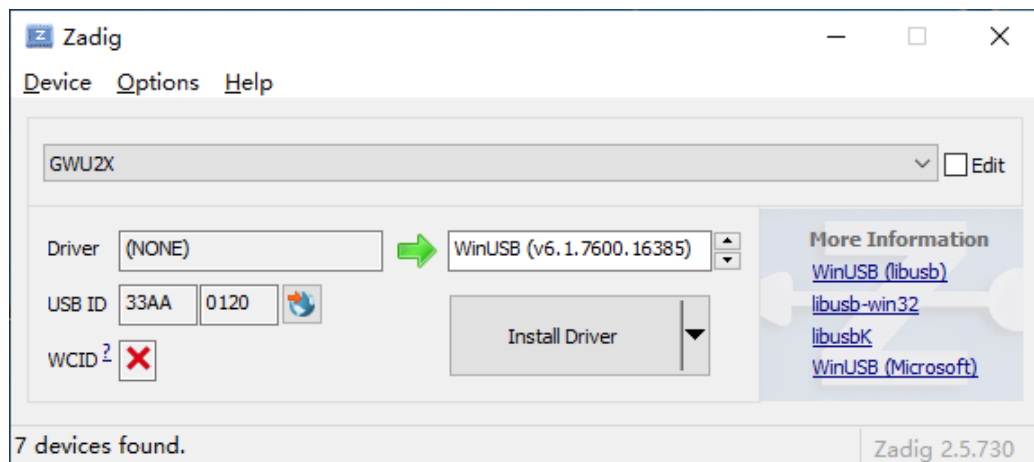
3. Select the GWU2X device that requires driver installation, as show in Figure 3-18.

Figure 3-18 Select the Device that Requires Driver Installation



4. Select the driver to be installed, use libusb+WinUSB, and select WinUSB, as show in Figure 3-19.

Figure 3-19 Select the Driver to be Installed



5. Click "Install Driver". The driver will be installed after a few moments.

Note!

The button displays "Install Driver" if the driver is not currently installed, and "Replace Driver" if another driver is currently installed.

3.2.2 Linux

Log in to the Gowin Semiconductor website, download the Linux version of Gowin Programmer, and after the download cable is connected with PC, start Programmer with root privileges. Then, the FPGA can be

configured for download via the download cable. Please refer to Chapter [3.3 USB-Cable Permission Configuration on Linux System](#) for detailed instructions on how to configure the permission of USB device driver to enable the Programmer to be used with regular user permission.

3.2.3 MacOS

The current Gowin IDE and download cable only support operating systems with Apple chip architecture, and the operating system already includes the required drivers.

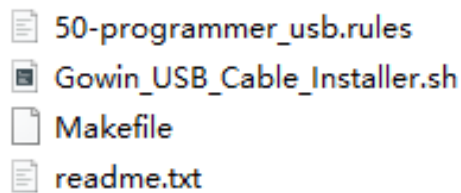
3.3 USB-Cable Permission Configuration on Linux System

In the \Programmer\bin folder, there are files as shown in Figure 3-20. Gowin_USB_Cable_Installer.sh is a script file and Makefile is a text file. Either way can be used to configure USB-Cable permission.

Note!

Some operating systems may require a reboot to apply the changes.

Figure 3-20 File List



3.3.1 Makefile

Open the terminal and enter the "sudo make" command or switch user to the root privilege. Enter the "make" command. If you see the message "File 50-programmer_usb.rules has been copied to /etc/udev/rules.d", it indicates a successful installation. Please note that for some CentOS 6 systems require a reboot to apply the changes, as shown in Figure 3-21 and Figure 3-22.

Figure 3-21 Example of Makefile Installation with Regular User Permission

```
fzq@localhost:~/software/application/cable_linux_privileges_20230417
File Edit View Search Terminal Help
[fzq@localhost cable_linux_privileges_20230417]$ sudo make

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for fzq:
File 50-programmer usb.rules has been copied to /etc/udev/rules.d/
[fzq@localhost cable_linux_privileges_20230417]$
```

Figure 3-22 Example of Makefile Installation with Root Privileges

```
fzq@localhost:/home/fzq/Desktop/cable_linux_privileges_20230414
File Edit View Search Terminal Help
[fzq@localhost cable_linux_privileges_20230414]$ su
Password:
[root@localhost cable_linux_privileges_20230414]# make
Please restart the system later to complete the setup
File 50-programmer usb.rules has been copied to /etc/udev/rules.d/
[root@localhost cable_linux_privileges_20230414]#
```

3.3.2 Gowin_USB_Cable_Install.sh

First open the folder where the programmer is located and check if all 4 of the above files exist. Then open the terminal, switch user to root privilege, give Gowin_USB_Cable_Installer.sh permission, and run Gowin_USB_Cable_Installer.sh. A “complete” display indicates that the installation was successful, as shown in Figure 3-23.

Figure 3-23 Script Installation Example

```
fzq@localhost:/home/fzq/Desktop/cable_linux_privileges_20230414
File Edit View Search Terminal Help
[fzq@localhost cable_linux_privileges_20230414]$ su
Password:
[root@localhost cable_linux_privileges_20230414]# chmod +x Gowin_USB_Cable_Installer.sh
[root@localhost cable_linux_privileges_20230414]# ./Gowin_USB_Cable_Installer.sh
Please restart the system later to complete the setup
complete !
[root@localhost cable_linux_privileges_20230414]#
```

