ARM® Cortex®- M

32-bit Microcontroller

NuMicro® ISP Programming Tool User Manual

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1 OVERVIEW

The NuMicro® Family microcontroller (MCU) supports In-System-Programming (ISP) function allowing the embedded Flash memory to be reprogrammed under software control. ISP is performed without removing the microcontroller from the system through the firmware and on-chip connectivity interface, such as UART, USB, I²C, SPI, CAN, LIN, Wi-Fi and BLE.

Before using the ISPTool, user needs to program the ISP code into LDROM by using a universal programmer or Nuvoton NuMicro® ICP Programming Tool, and the User Configuration bit 'CBS' configured as Boot from LDROM.

ISPTool came with two different modes. One is the GUI mode, which is more user friendly, with an easily to use front end allowing user to control with simple mouse click. The other one is command line mode, this mode is suitable to combine with shell script for automation control. These two modes will be introduced in Chapter 2 and Chapter 3.

ISP code can be found in the board support package (BSP). Take M480BSP for example, we supplied ISP_CAN, ISP_HID, ISP_HID_20, ISP_I2C, ISP_RS485, ISP_SPI and ISP_UART samples as shown in the following link.

https://github.com/OpenNuvoton/M480BSP/tree/master/SampleCode/ISP

The ISPTool repository is available on GitHub.

Please check the following link to get the latest update.

https://github.com/OpenNuvoton/ISPTool

2 USING THE ISP PROGRAMMING TOOL IN WINDOWS

The ISP Programming Tool is contained in the folder [Application Program].

2.1 Connecting Interface Selection

Before using the ISP function, users need to select the appropriate ISP connection interface and ensure that the I/O pins used for communication are correctly connected. It's important to note that not all interfaces are supported by every type of microcontroller.

Different interfaces require distinct connection settings. For instance, when using the ISP USB interface, an extra entry pin must be tied to the ground pin to activate ISP mode. For the ISP Wi-Fi and ISP BLE interfaces, ensure that Wi-Fi and BLE access are enabled on the PC. For specifics on supported interfaces and connection pins, please consult the BSP sample codes.

For the ISP UART interface, information about the Virtual COM port is necessary. Meanwhile, for the ISP Wi-Fi interface, you'll need the IP address and port details.

Lastly, users should verify that the target board is compatible with their chosen interface. For the CAN interface, a CAN transceiver is essential. For the wireless interface, a module that supports both Wi-Fi and BLE is necessary. The module connects to the target chip via UART. It functions as an Access Point, providing "Wi-Fi UART pass-through" capability for the Wi-Fi interface. It also operates as a BLE server, offering "BLE UART pass-through" functionality for the BLE interface.

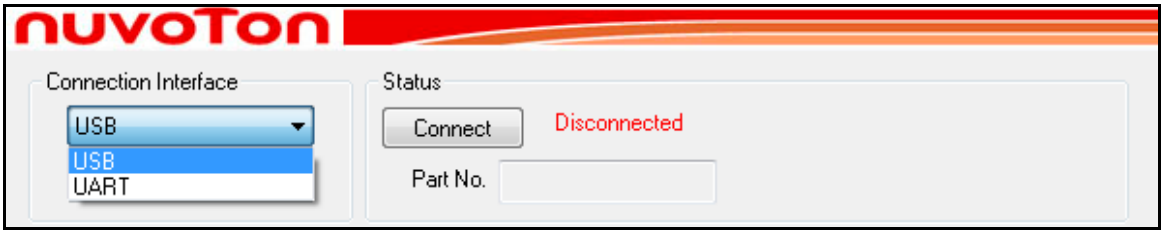

Figure 2-1 Connection via USB Interface

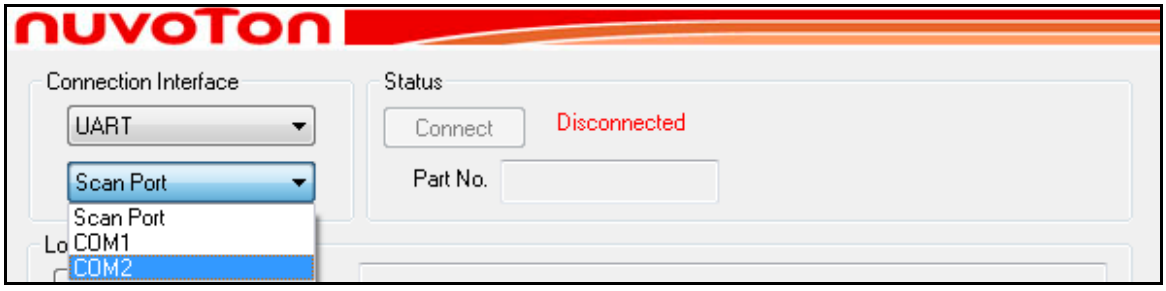

Figure 2-2 Connection via UART Interface using specific COM port

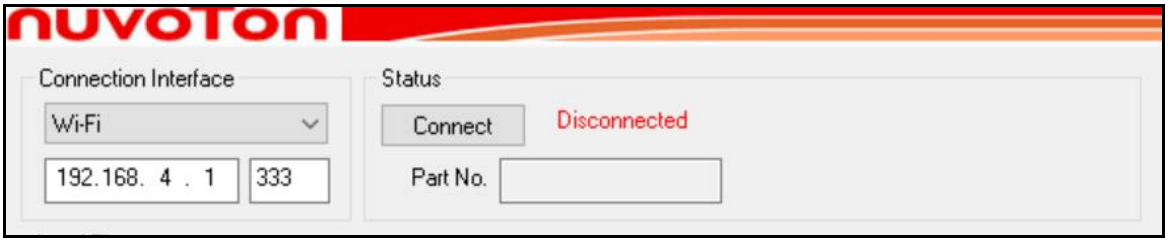

Figure 2-3 Connection via Wi-Fi Interface

2.2 Connection Interface via Nu-Link2-Pro

Since version 3.00, there are more connection interfaces available for customer's product decision. A Nu-Link2-Pro adapter is necessary to use these interfaces. For now, SPI, I2C, RS485, CAN and LIN interfaces is supported by using Nu-Link2-Pro. Users can either use the Nu-Link2 firmware by setting BRIDGE-MODE to ISP_LDROM or opt for the ISP Bridge firmware.

Please check the Chapter 3 of the Nu-Link2-Pro Debugger and Programmer User Manual for the interface connection details. Nu-Link2-Pro Debugger and Programmer User Manual can be downloaded from Nuvoton Official Website, or by the following link mentioned in Github: OpenNuvoton/Nuvoton_Tools:

https://www.nuvoton.com/resource-download.jsp?tp_GUID=UG1320200319174043

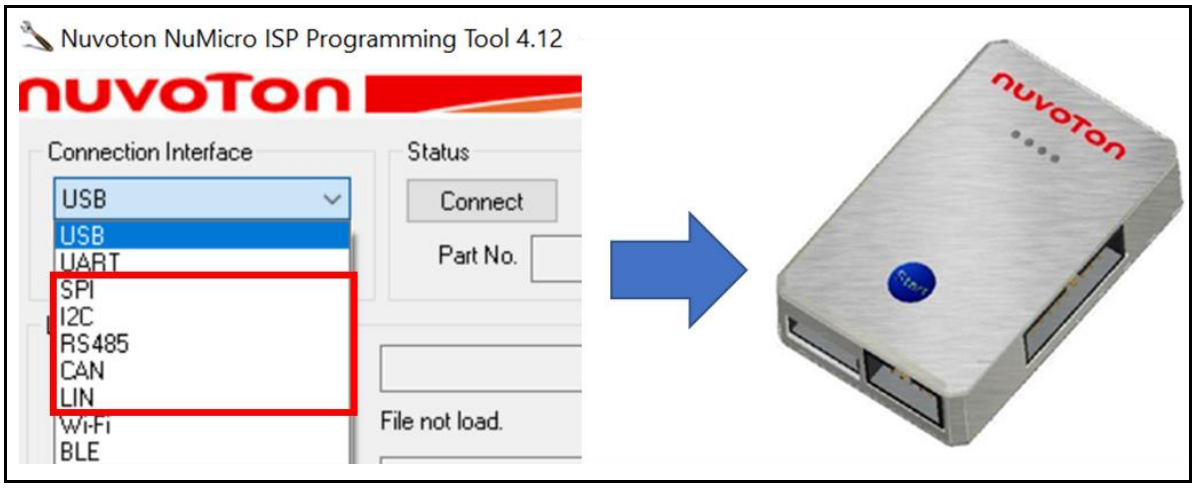

Figure 2 4 Connection Interface via Nu-Link2-Pro ISP-Bridge functionality

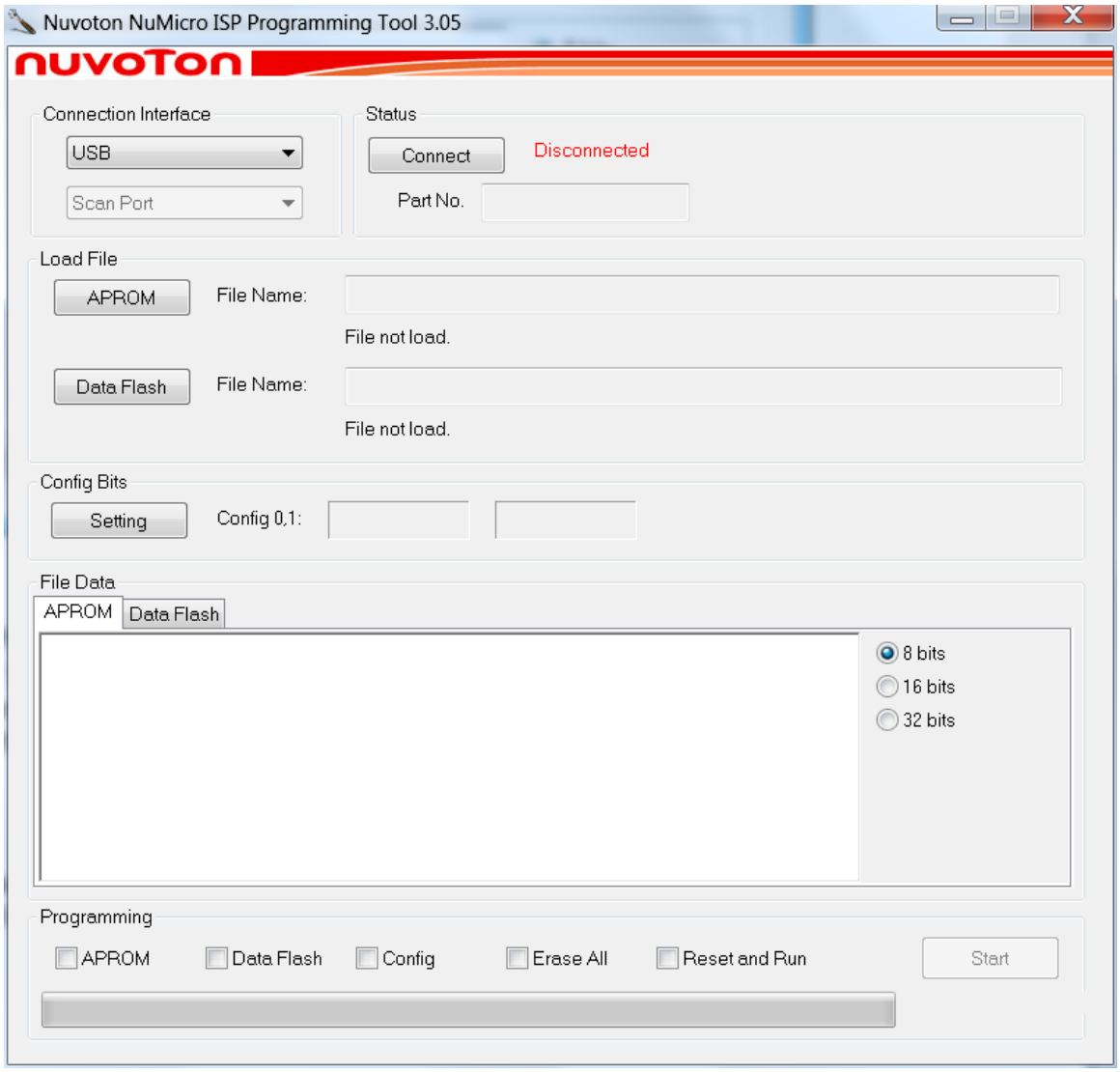

Figure 2-5 Main Dialog

2.3 Connecting to the target chip

After clicking the "**Connect**" button, the ISP tool will keep trying to connect to a target board every 40 milliseconds (200 milliseconds for LIN, Wi-Fi and BLE interfaces) until the target board is successfully connected or the "**Stop**" button is clicked. If there is no response from the target board during connection, please reset the MCU to execute the ISP code.

If the connection is successful, the ISP tool should display information about the target's part number, APROM size, and Data Flash size. If the information shown on the ISP tool differs from the target, there might be a connection error. Please try to connect again.

2.4 Load File

Click the "**APROM**" or "**Data Flash**" button to select the image from the pop-up window. Or using drag & drop function from Windows Explorer to select the image file.

For now, binary file (.bin) is the only acceptable image file type for ISPTool.

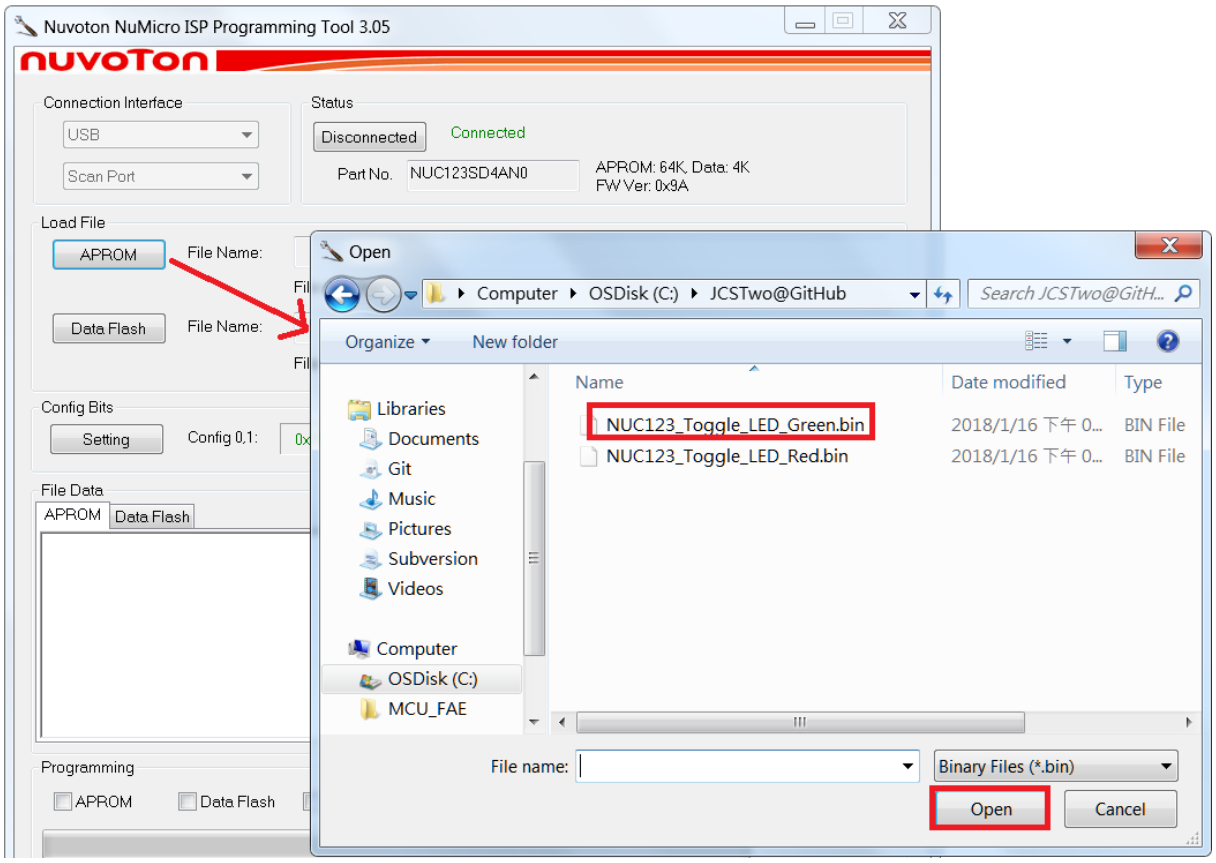

Figure 2-6 Click Button to Load Image file

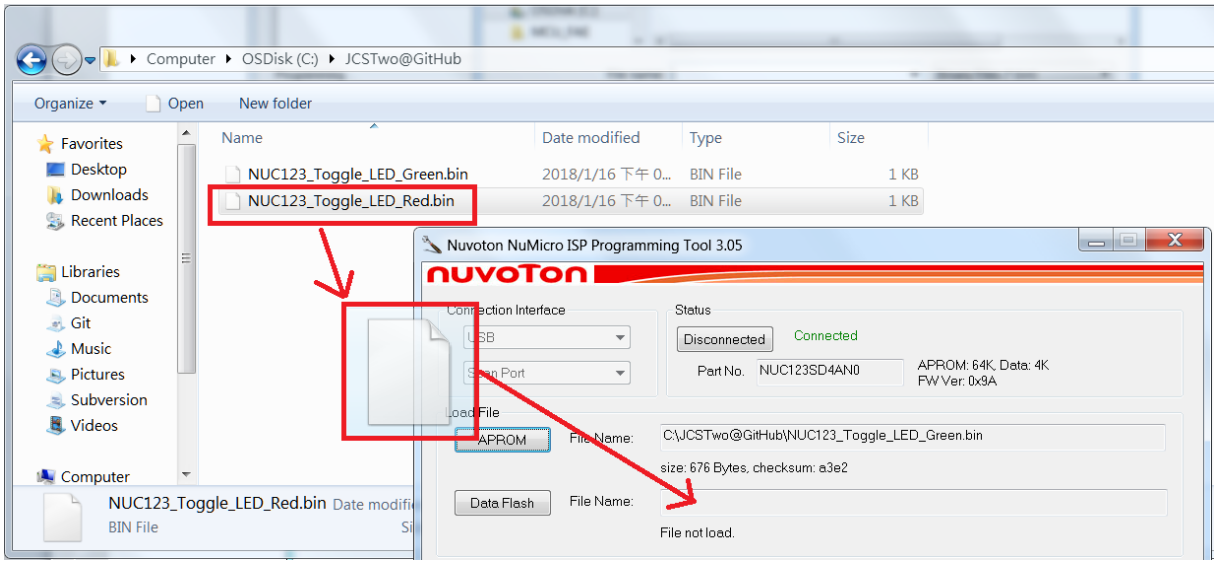

Figure 2-7 Drag image file from explorer window

2.5 Setting the User Configuration Bits

When the ISPTool connects to the target chip, it reads the User Configuration settings from the target board. These settings are then displayed in the Config Bits Group Box in green text.

After clicking the "**Setting**" button, a "**User Configuration**" dialog appears, showing all User Configuration settings. The specific "User Configuration" dialog displayed corresponds to the MCU currently connected. For instance, Figure 2.8 illustrates the "**User Configuration**" settings for the NUC123AN series MCU.

It's important to note that the ISP tool does not permit users to modify the target board's boot selection. The "**Boot Select**" displayed in the User Configuration form is purely informational. To update this setting, users should utilize the Nuvoton NuMicro® ICP Programming Tool.

If users modify settings in the "**User Configuration**" dialog and then click the "**OK**" button, it doesn't immediately alter the config values on the board. Any changed values will be highlighted in the Config Bits Group Box in red text. These modified config values will be written only when users proceed with ISP Programming, using the config option mentioned in Chapter 2.6.

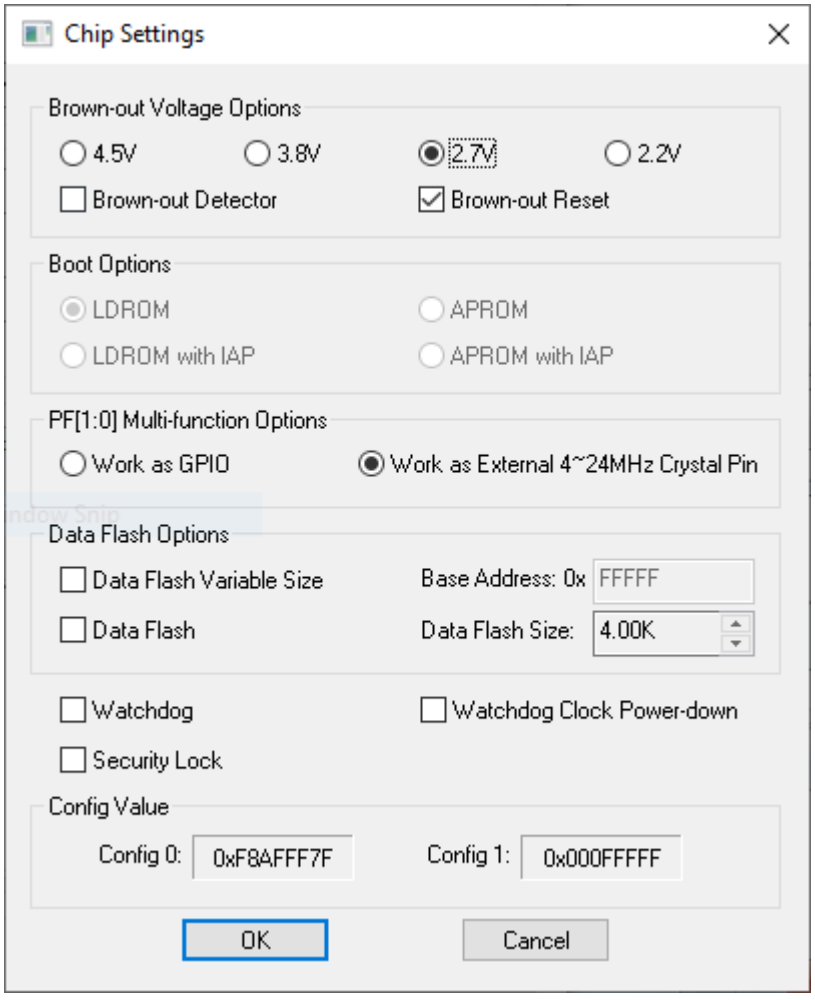

Figure 2-8 User Configuration Dialog

2.6 Programming Options

The following table lists the ISP actions for different programming options. The SPI Programming options are available for specific series like M487KMCAN. Please refer to the ISP_UART_SPIFLASH_M487KM sample for more detailed information.

Programming Options	ISP Actions
APROM	APROM will be updated.
Data Flash	Data Flash will be updated.
Config	User Configuration will be updated while target chip is not in write protected mode. 1. User Configuration is in write protected mode when security lock is enabled. 2. Program APROM or Erase All option can remove write protection of User Configuration. Note: Any change on User Configuraion block will take effect after system reboot.
Erase All	APROM and Data Flash will be erased. The Security Lock in User Configuration will be disabled.
Reset and Run	The system reset is issued and the chip is running user application on APROM.
SPI Flash	SPI Flash will be updated.
Erase SPI Flash	SPI Flash will be erased.

Table 2-9 ISP Programming Options

3 ISPTOOL COMMAND LINE INTERFACE

3.1 Command Format

The command format of ISPTool is shown as follows:

```
> NuvoISP.exe [-aprom BINFILE] [-nvm BINFILE] [-interface INTF] [-run] [-batch]
```

Note: The command format is case sensitive

Where user can use "**-aprom**" or "**-nvm**" to update ARPOM or Data Flash and the BINFILE is the image file. "**-interface**" is to specify the connection interface INTF, currently only USB and UART interfaces are supported. For UART interface, user should specify the port number, for example as "COM5". For USB interface, user should assign INTF as "HID". "**-run**" is used to trigger the system reset and force the chip to execute the application on APROM. "**-batch**" is used to batch programming multiple devices.

3.2 Script Examples

The first example shows how to program ARPOM through UART interface. The batch file contains only two lines as follows and is put together with the image file "USBD_HID_Mouse.bin"**.**

```
NuvoISP.exe -aprom USBD_HID_Mouse.bin -interface COM10 -run
pause
```

Double click the batch file shows the following result.

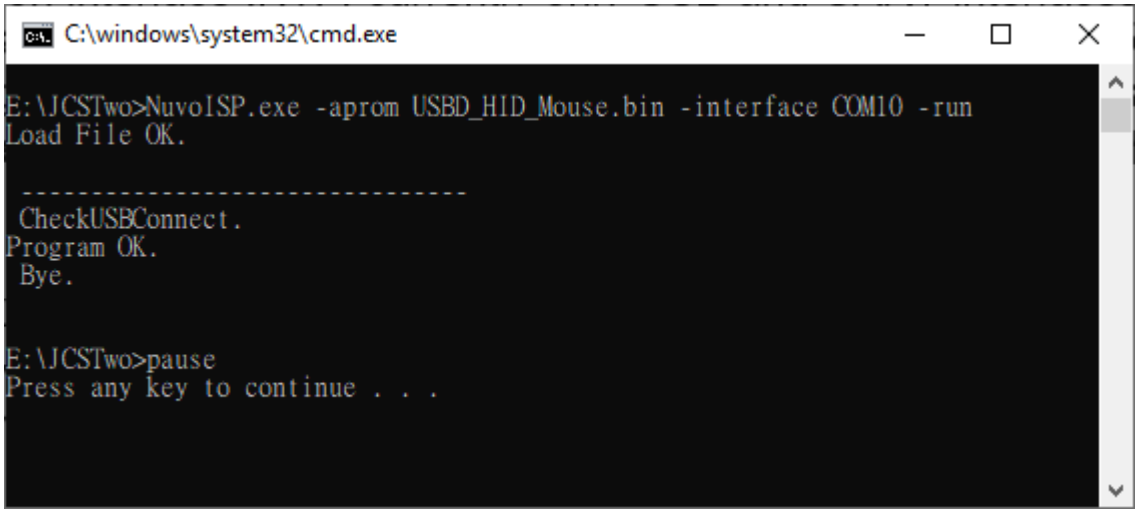

Figure 3-1 programming result

The second example shows how to program aprom through USB interface in batch mode.

```
NuvoISP.exe -aprom USBD_MassStorage_CDROM.bin -interface HID -batch
pause
```

Double click the batch file shows the following result. In batch mode, the ISPTool will repeat to execute the script command until user closes the console window.

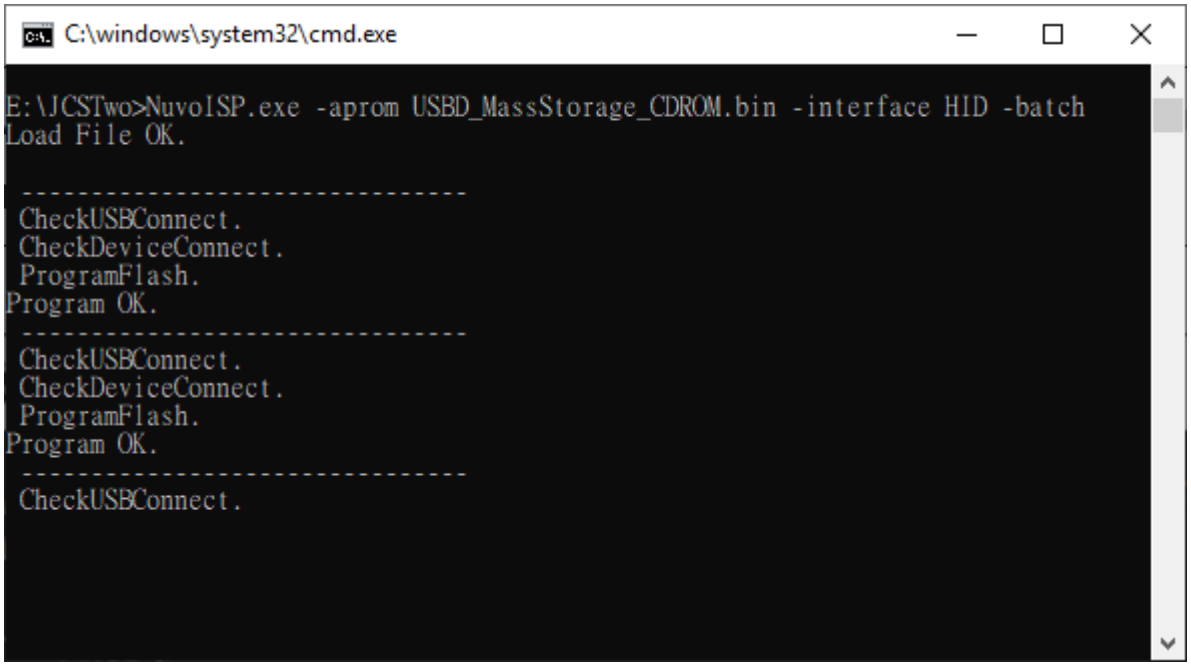

Figure 3-2 batch programming result

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