



NuMicro[™] ISP Programming Tool User Manual

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1 Overview

ISP is the acronym of **In-System Programming**, which makes it possible that the user can update the program memory under the software control without removing the mounted MCU chip from the actual end product. Nuvoton provides an ISP solution through the USB or COM port of a host PC. As long as the *Nuvoton standard ISP code* is programmed in LDROM and the configuration bit 'CBS' is configured as *Boot from LDROM*, the user can easily use the ISP function to update the MCU's APROM and Data Flash, and even the configuration bits.

Note

- (1) *For the NuMicro MCU products, the on-chip Flash memory are partitioned into three blocks: APROM, Data Flash and LDROM. The APROM saves the user's application program developed for specific application; the Data Flash provides a storage for nonvolatile application data; and the LDROM saves the ISP code for MCU itself to update its APROM/Data Flash/CONFIG.*
- (2) *The Nuvoton standard ISP code is also included in the folder [(2) Nuvoton Standard ISP Code]. The user may program this ISP code into LDROM by using a universal programmer or the Nuvoton proprietary tool, 'NuLink ICP Programmer'.*

2 Preparation for ISP Function

Two ISP types are supported, 'ISP through COM port' and 'ISP through USB'. For either of these two types, the configuration bit 'CBS' needs to be configured as *Boot from LDRom* and some specific I/O pin needs to be tied to ground, as indicated in the following table. The file name of the *Nuvoton standard ISP code* is also included.

ISP Type	MCU Parts	UART port	I/O Pin Tied to Ground for USB	Nuvoton Standard ISP Code Programmed in LDRom
ISP through COM Port	M051-series	UART0 P3.0/P3.1	-	ISP_Code_M051_v2.4.bin
	NUC100/120/130/140	UART0 PB.0/PB.1	-	ISP_Code_NUC100_UARTOnly_v2.4.bin
	NUC101	UART1 PB.4/PB.5	-	ISP_Code_NUC100_v2.4.bin
	Mini51	UART0 P0.0/P0.1		ISP_Code_Mini51_v2.4.bin
	Nano100	UART0 PA.14/PA.15		ISP_Code_NANO_UARTOnly_v2.4.bin
	Nano112	UART0 PB.13/PB.14		ISP_Code_Nano112_v2.4.bin
	NUC122	UART1 PB.4/PB.5		ISP_Code_NUC122_UARTOnly_v2.4.bin
	NUC123	UART1 PB.4/PB.5		ISP_Code_NUC123_UARTOnly_v2.4.bin
	NUC200	UART0 PB.0/PB.1		ISP_Code_NUC200_UARTOnly_v2.4.bin
ISP through USB and COM Port	NUC120/140	UART0 PB.0/PB.1	PB.15	ISP_Code_NUC100_v2.4.bin
	NUC101	UART1 PB.4/PB.5	PD.0	ISP_Code_NUC100_v2.4.bin
	NUC200	UART0 PB.0/PB.1	PB.15	ISP_Code_NUC200_v2.4.bin

	Nano100-series	UART0 PA.14/PA.15	PB.15	ISP_Code_NANO_v2.4.bin
	NUC122	UART1 PB.4/PB.5	PA.10	ISP_Code_NUC122_v2.4.bin
	NUC123	UART1 PB.4/PB.5	PB.14	ISP_Code_NUC123_v2.4.bin

Table 2-1 ISP firmware list

2.1 Pin Assignment for Extended Connectors

The following diagram shows the hardware connection for 'ISP through COM port'. Note that UART0 is used to connect to PC's COM port for M051-series and NUC100/120/130/140 while UART1 is used for NUC101. In addition, an RS232 transceiver (e.g. MAX232) is always needed between MCU chip and PC's COM port.

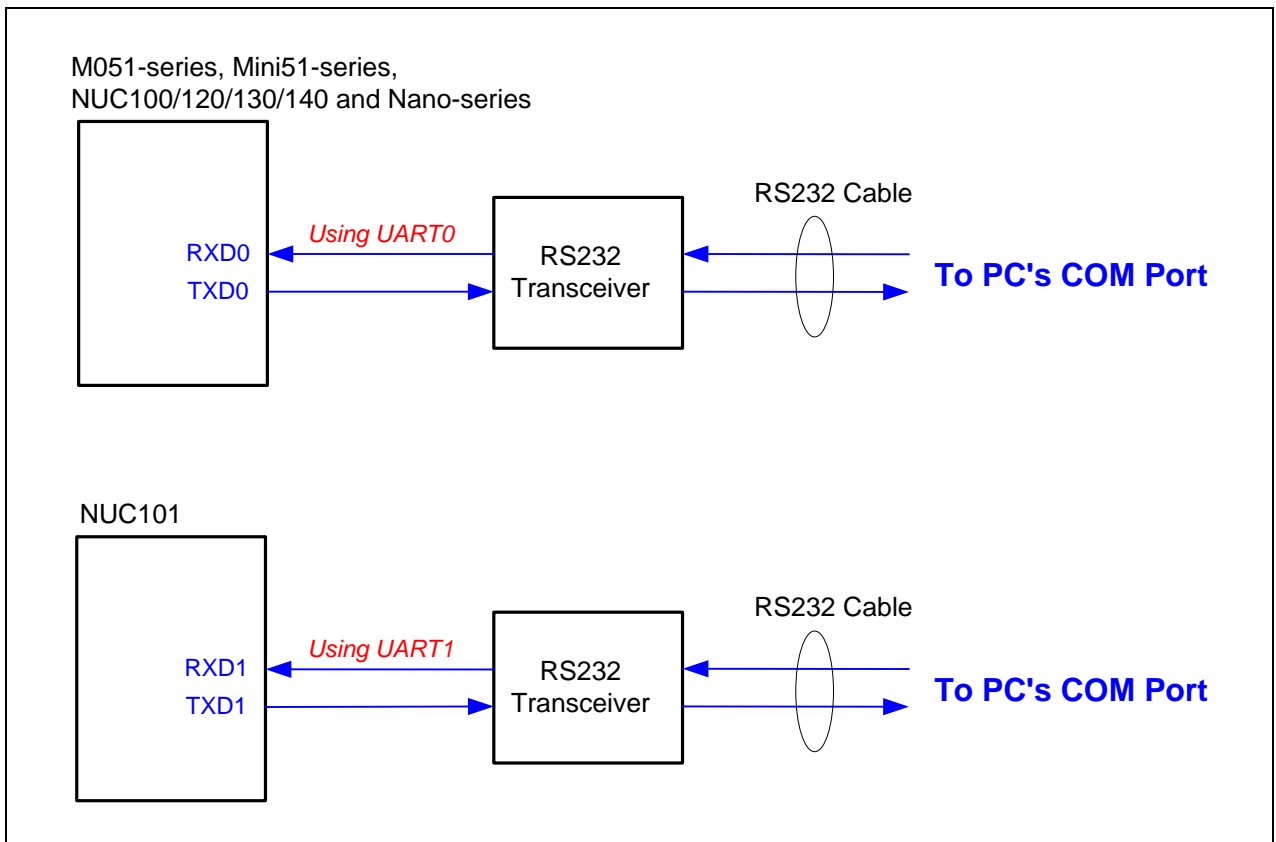


Figure 2-1 ISP through UART

2.2 Hardware Connection for 'ISP through USB'

The following diagram shows the hardware connection for 'ISP through USB'. Note that connecting PB.15 (for NUC120/140) or PD.0 (for NUC101) to ground is necessary.

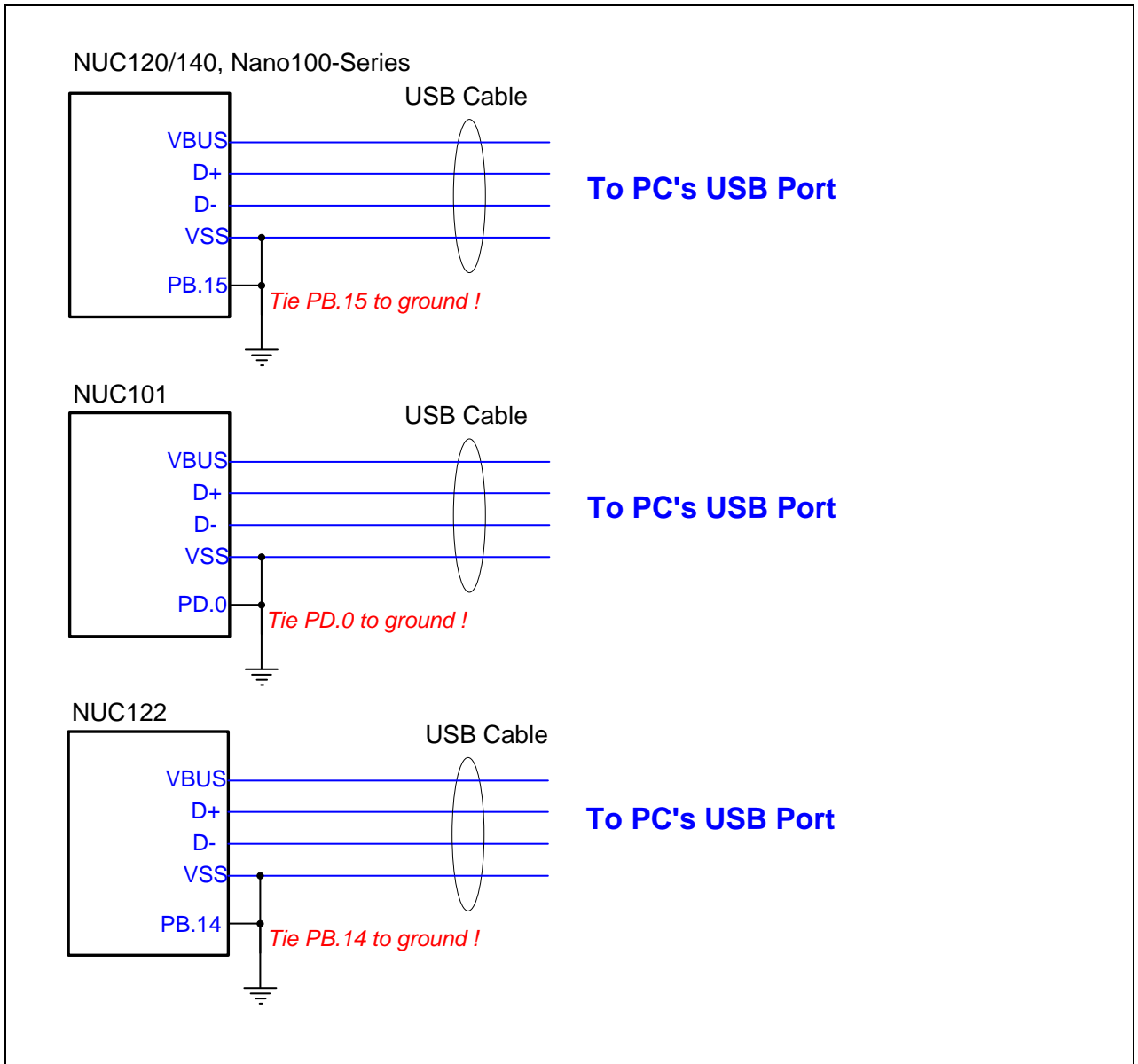


Figure 2-2 ISP through USB

3 PC-site Application Program

3.1 Install the Application Program

The application program setup file is contained in the folder [(1) Application Program]. Using the default installation setting, you will find the item “*Nuvoton Tools \ Nuvoton NuMicro ISP Programming Tool, v1.44*” appearing in the Windows START-menu after the application program is successfully installed.

3.2 Introduction to the Application Program

The Figure 3-1 shows the GUI of the ISP tool. The user needs to select the ISP connection type, USB or COM port, before using the ISP function.

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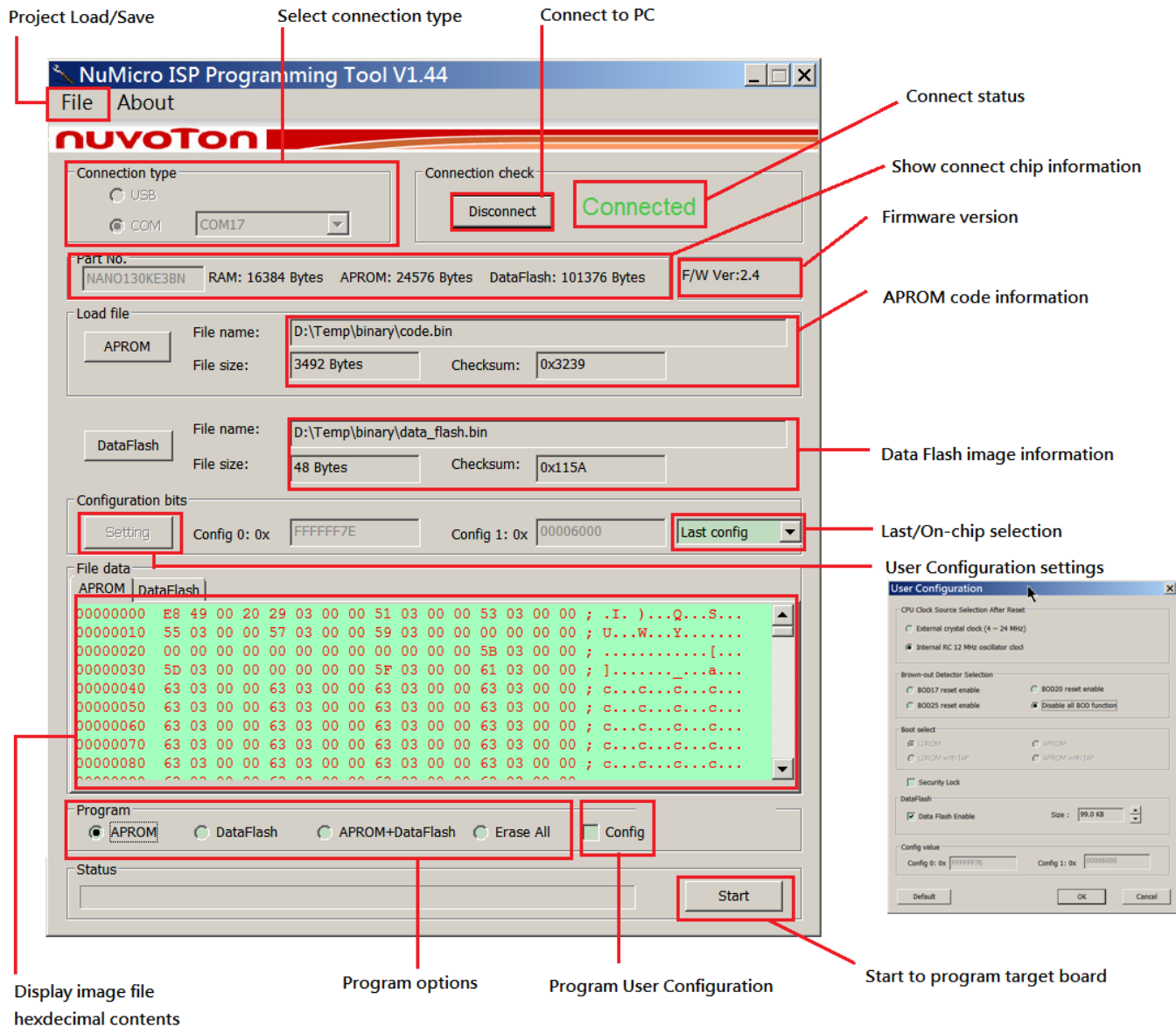


Figure 3-1 ISP tool user interface

3.2.1 Setting of Configuration Bits

To retrieve the CONFIG setting dialog, click the 'Setting' button when 'Config' is included as a program item. A 'User Configuration' dialog will be pop-up to display all settings in User Configuration. Due to the differences between different chip series, a corresponding User Configuration dialog will be shown depend on the chip currently connected. The following figure is the User Configuration setting dialog of

Nano100 series chips.

Any new selection will be immediately reflected to '**Config value**'. It's not allowed to edit 'Config 0' and 'Config 1' directly.

ISP tool does not tend to modify target board boot selection. The '**Boot Select**' shown in User Configuration dialog is to display only, and not for change.

Some of the items can be selected only if they are enabled. For example, user can select Data Flash size only when '**Data Flash Enable**' was checked.

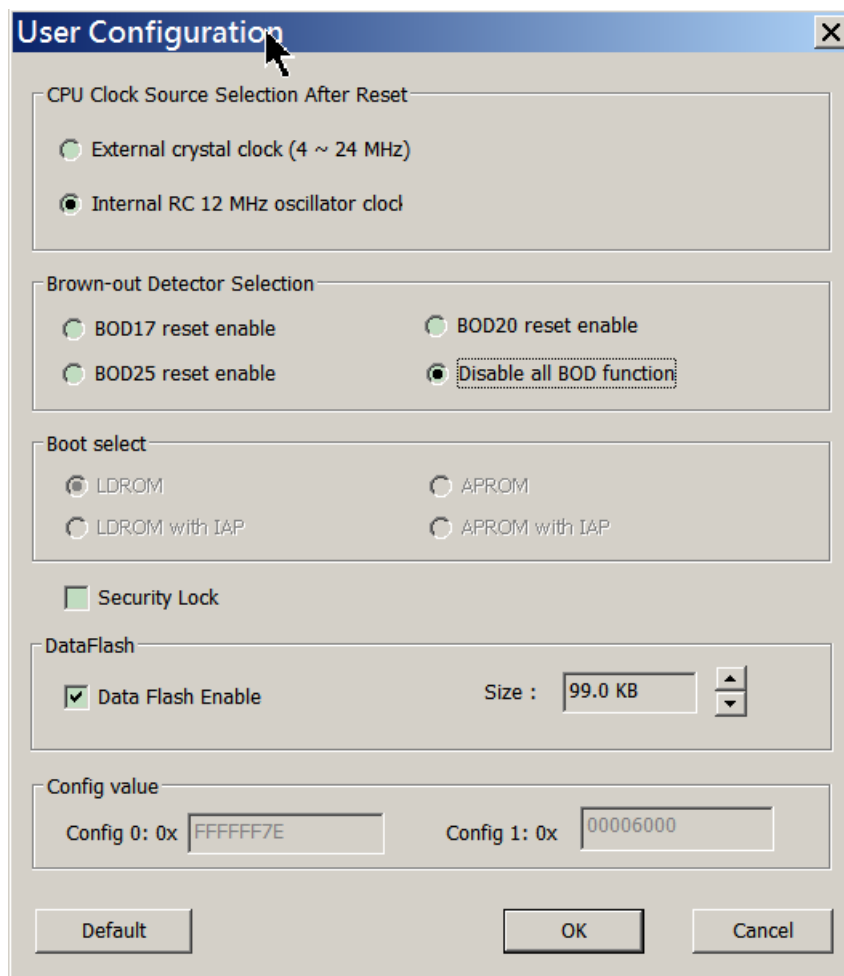


Figure 3-2 User Configuration dialog

3.2.2 Programming Item

Table 3-1 lists the ISP actions under different programming items.

Programming Items	ISP Actions
APROM	APROM: will be updated. Data Flash/Config: will be kept unchanged.
APROM & Config	APROM/CONFIG: will be updated. Data Flash: will be kept unchanged.
Data Flash	Data Flash: will be updated. APROM/CONFIG: will be kept unchanged.
APROM+Data Flash	APROM/Data Flash: will be updated. CONFIG: will be kept unchanged.
APROM+Data Flash & Config	APROM/Data Flash/CONFIG: will be updated.
Erase ALL	APROM/Data Flash/CONFIG: will be erased.

4 Start to Use the ISP Function

4.1 ISP through COM Port

Please follow the steps listed below.

Step 1: Select connection type as '**COM**' and the port number to which the target system is connected.

Step 2: Click 'Connect' button.

Step 3:

(Condition 1) If the target system was in power-off state, turn on the target system.

(Condition 2) If the target system was already powered on, reset the MCU chip.

Now, the connection status will switch to 'Connected' state.

Step 4: Select the wanted programming item.

Step 5: Click 'APROM' or 'Data Flash' button to load file into their individual buffer for the following programming. If need, click 'Setting' button to set the configuration bits.

Step 6: Click 'Start' button to start ISP programming.

Once the programming is finished, the MCU chip will automatically jump to APROM to run the new code just programmed. And, at this time the connection status will switch to 'Disconnected' state. To connect the target system to the host once again, repeat Steps 2~6.

See the following figure for Steps 1 to 6.

- Step 1: Select connection type as '**COM**', and select the COM port.

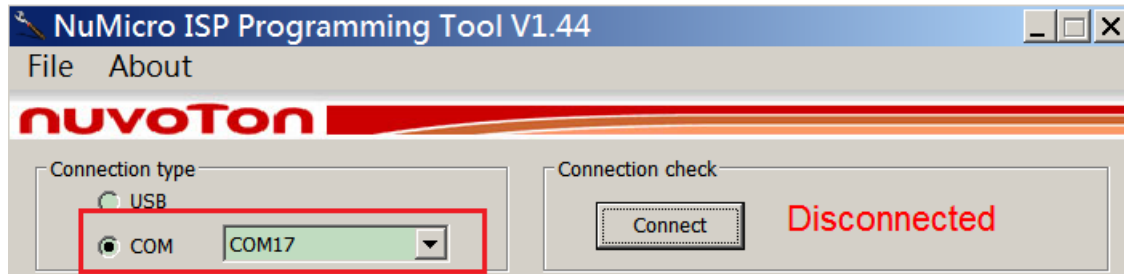


Figure 4-1 Select COM port

- Step 2: Press the 'Connect' button. ISP tool will keep trying to connect target board with 20 ms time interval. User will see ISP tool detecting target board. At this time, user should reset the target board to let ISP firmware be executed.

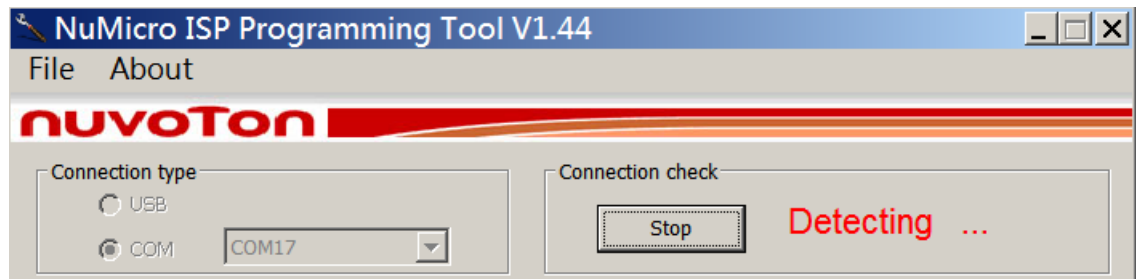


Figure 4-2 Connecting COM port

- Step 3: Once connection was created, user can see ISP tool show information as the following figure.

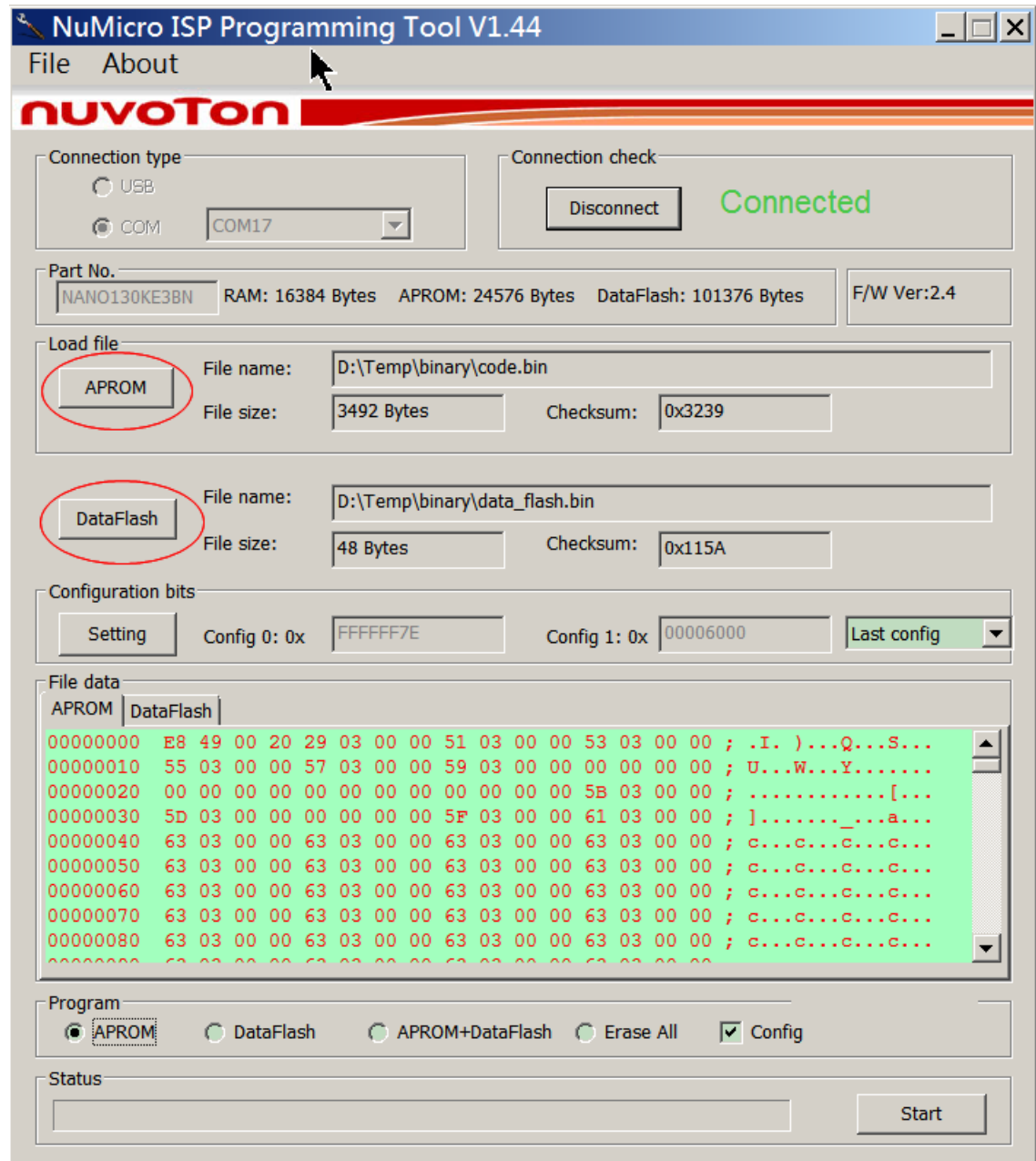


Figure 4-3 ISP connected

- Step 4: Press the '**APROM**' button shown in the above figure and then select the image to be programmed to APROM from the pop-up window. Press the '**DataFlash**' button shown in the above figure and then select the data to be programmed to Data Flash from the pop-up window.
- Step 5: In the '**Program**' area shown in the following figure, select one from '**APROM**', '**DataFlash**', '**APROM+DataFlash**', and '**Erase All**'. The '**APROM**' selection is to program APROM image only. The '**DataFlash**' selection is to program Data Flash only. The '**APROM+DataFlash**' selection is to program both APROM and Data Flash. The '**Erase All**' section is to erase the whole chip, including User Configuration.

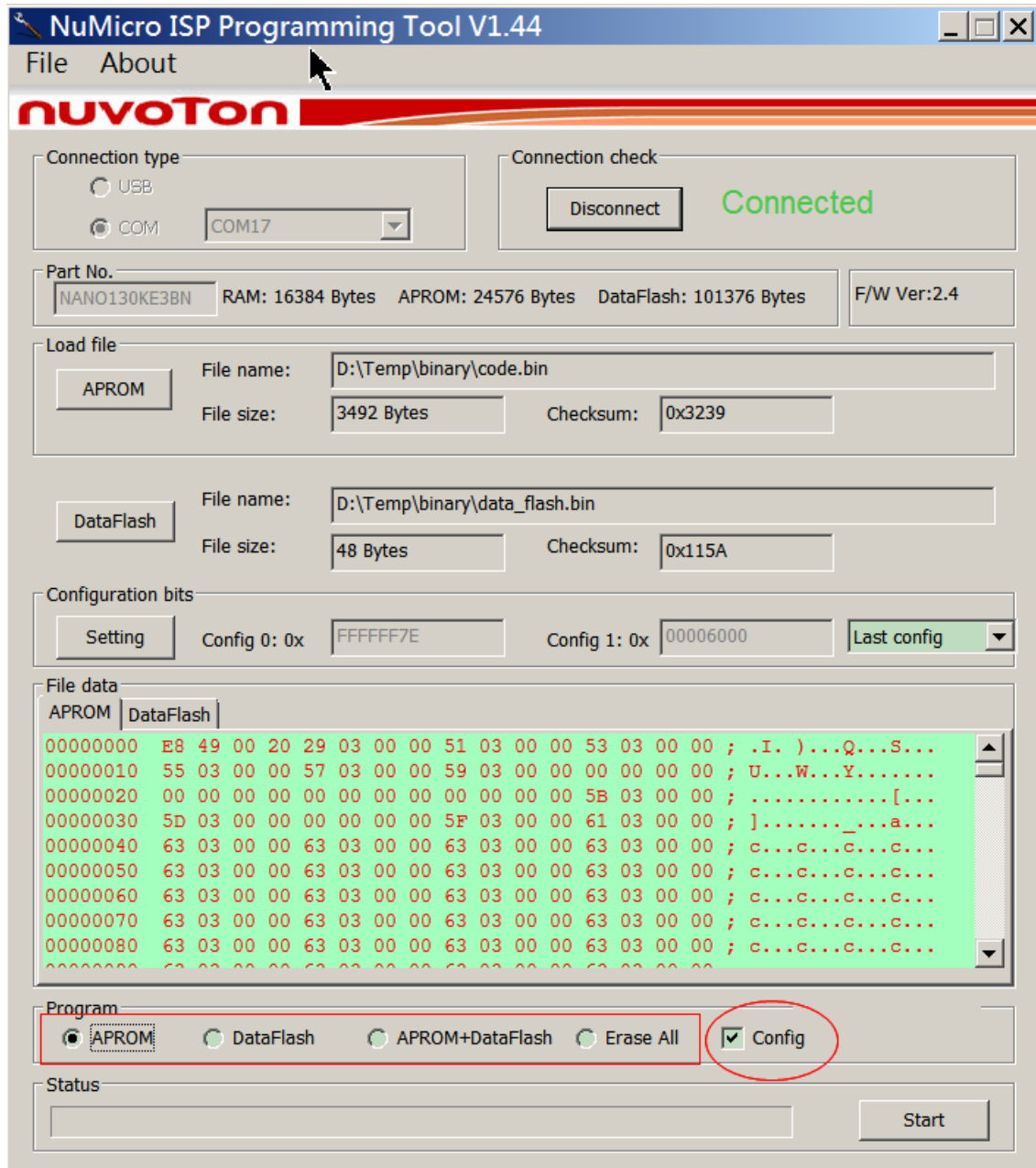


Figure 4-3 Select program items

- Step 6: If user want to modify User Configuration at the same time, please check the 'Config' box as circled in the above figure. Refer to '錯誤! 找不到參照來源。' to properly configure the User Configuration before starting program the target board.

- Step 7: Press '**Start**' button to start program the target board. The program status and result will be shown in the '**Program**' area. See the following figure.

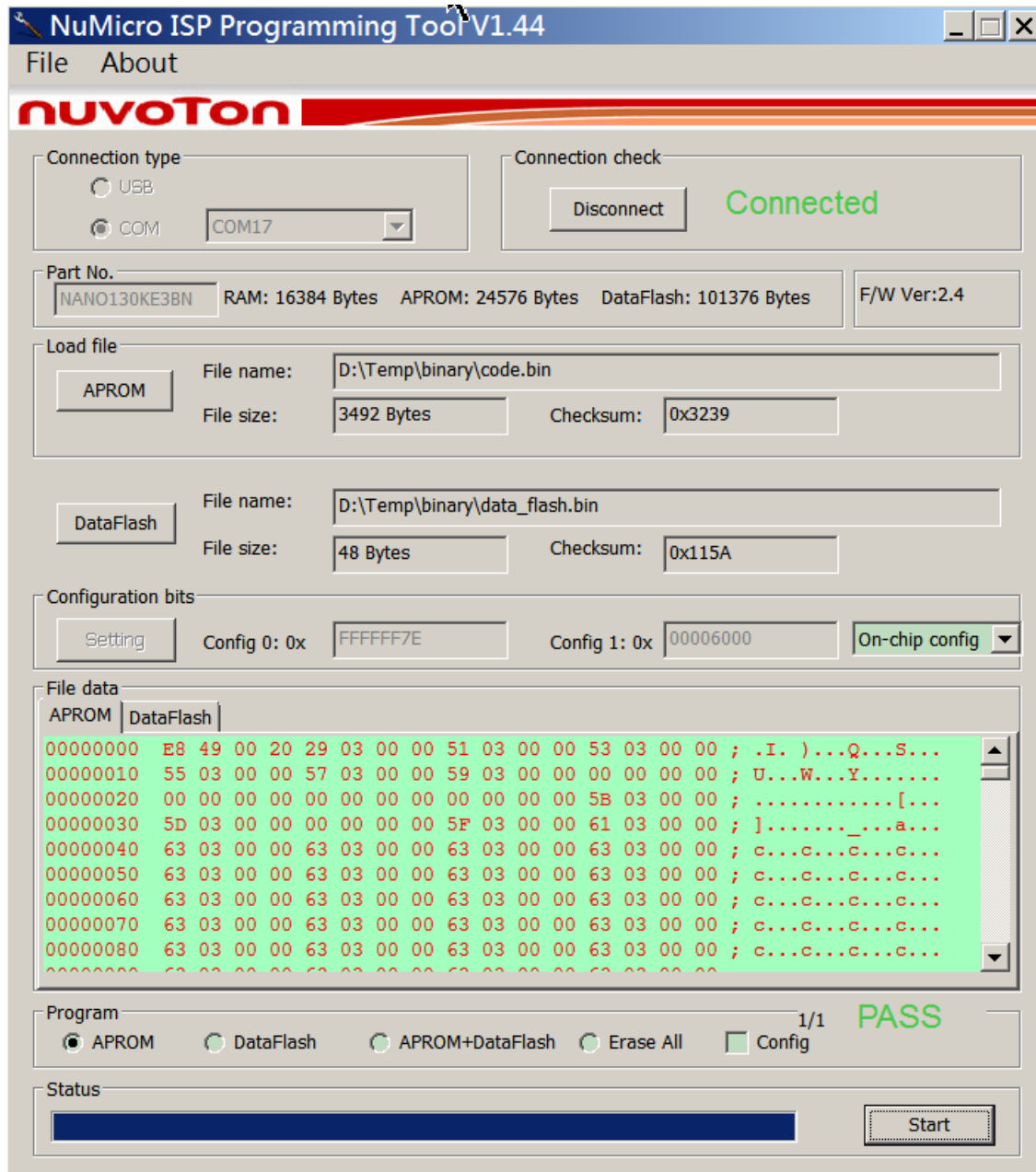


Figure 4-4 Program result

4.2 ISP through USB

Please follow the steps listed below.

- Step 1: Select connection type as 'USB'.

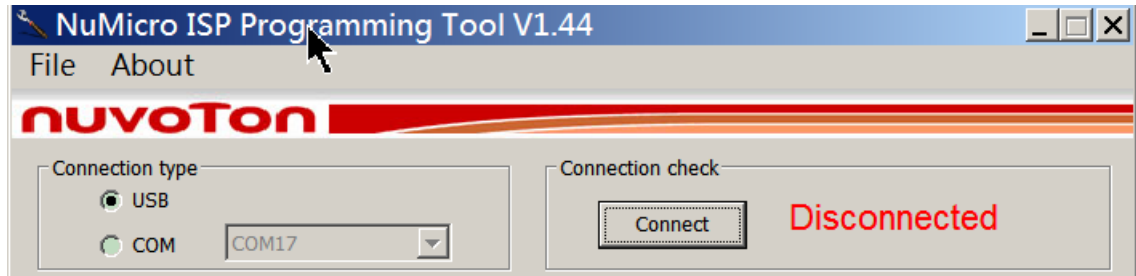


Figure 4-5 Select USB

- Step 2:
(Condition 1) If the target board was in power-off state, turn on the target board.
(Condition 2) If the target board was already powered on, reset the MCU chip.
- Step 3: Click 'Connect' button after USB bus enumeration is completed. The connection status will switch to 'Connected' state if connecting success.

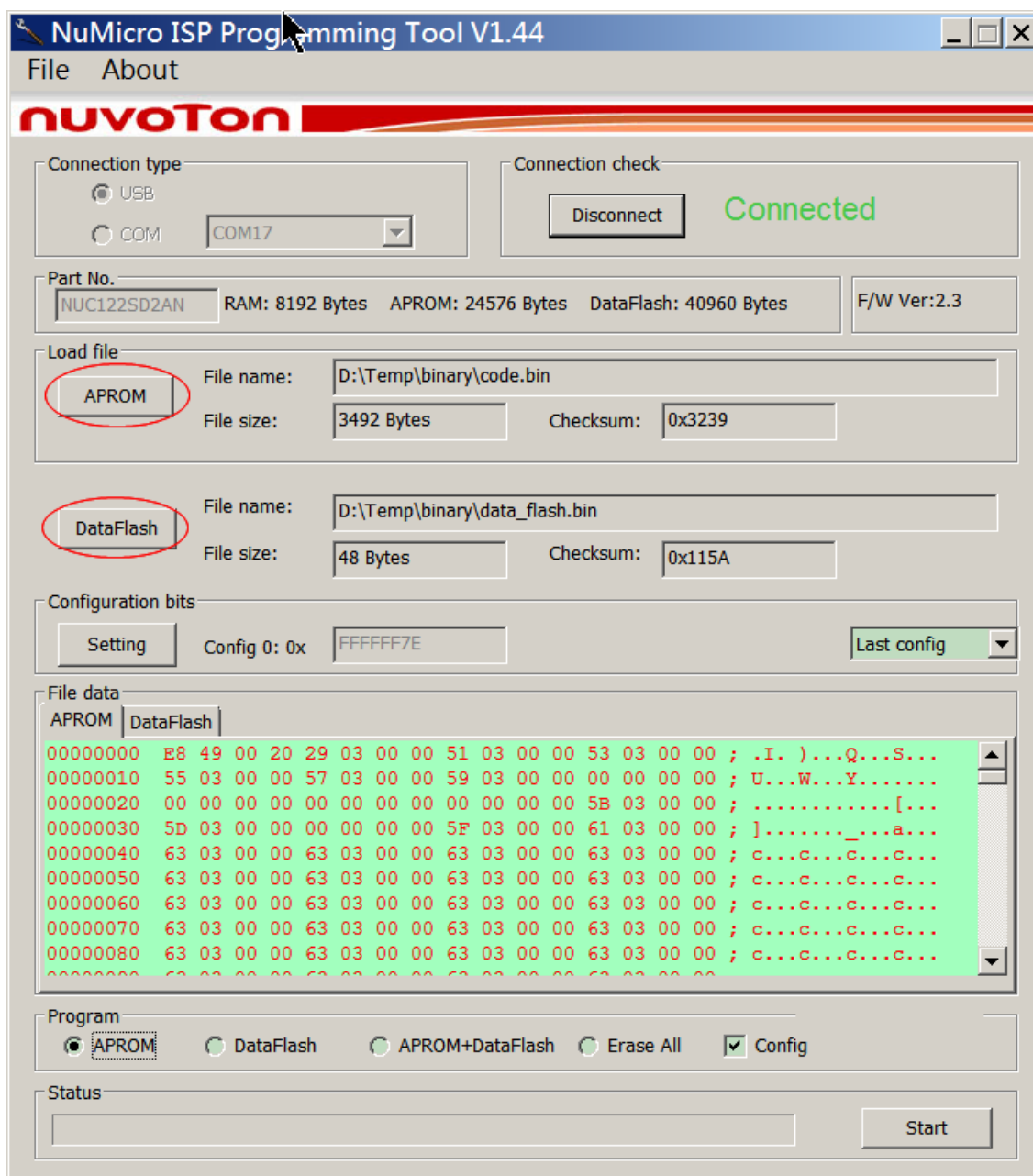


Figure 4-6 ISP connected via USB

- Step 4. Press the '**APROM**' button shown in the above figure and then select the image to be programmed to APROM from the pop-up window. Press the '**DataFlash**' button shown in the above figure and then select the data to be programmed to Data Flash from the pop-up window.
- Step 5: In the '**Program**' area shown in the following figure, select one from

‘APROM’, ‘DataFlash’, ‘APROM+DataFlash’, and ‘Erase All’. The ‘APROM’ selection is to program APROM image only. The ‘DataFlash’ selection is to program Data Flash only. The ‘APROM+DataFlash’ selection is to program both APROM and Data Flash. The ‘Erase All’ section is to erase the whole chip, including User Configuration.

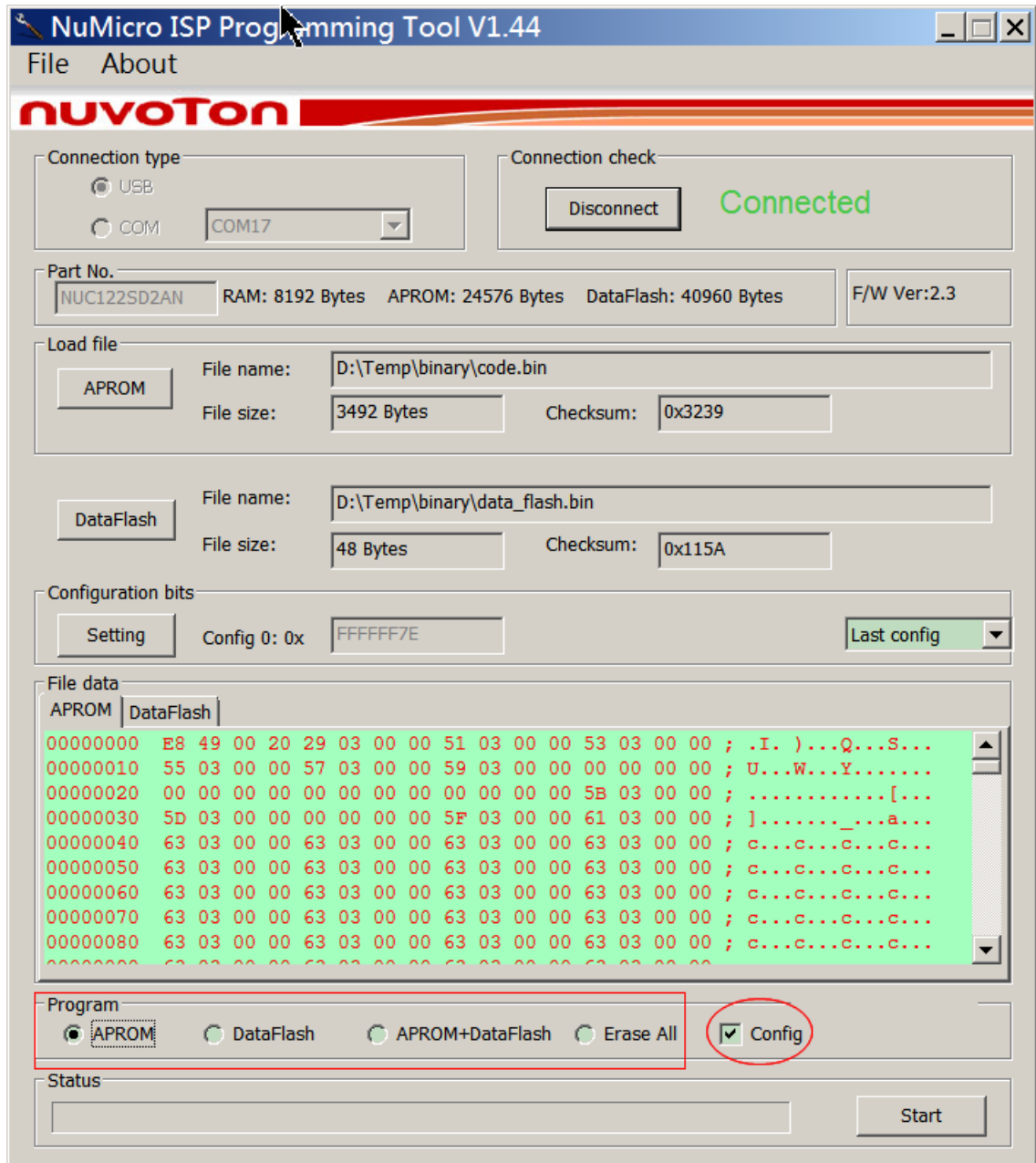


Figure 4-7 Select program items

- Step 6: If user want to modify User Configuration at the same time, please check the 'Config' box as circled in the above figure. Refer to '3.2.1 Setting Configuration Bits' to properly configure the User Configuration before starting program the target board.
- Step 7: Press 'Start' button to start program the target board. The program status and result will be shown in the 'Program' area. See the following figure.

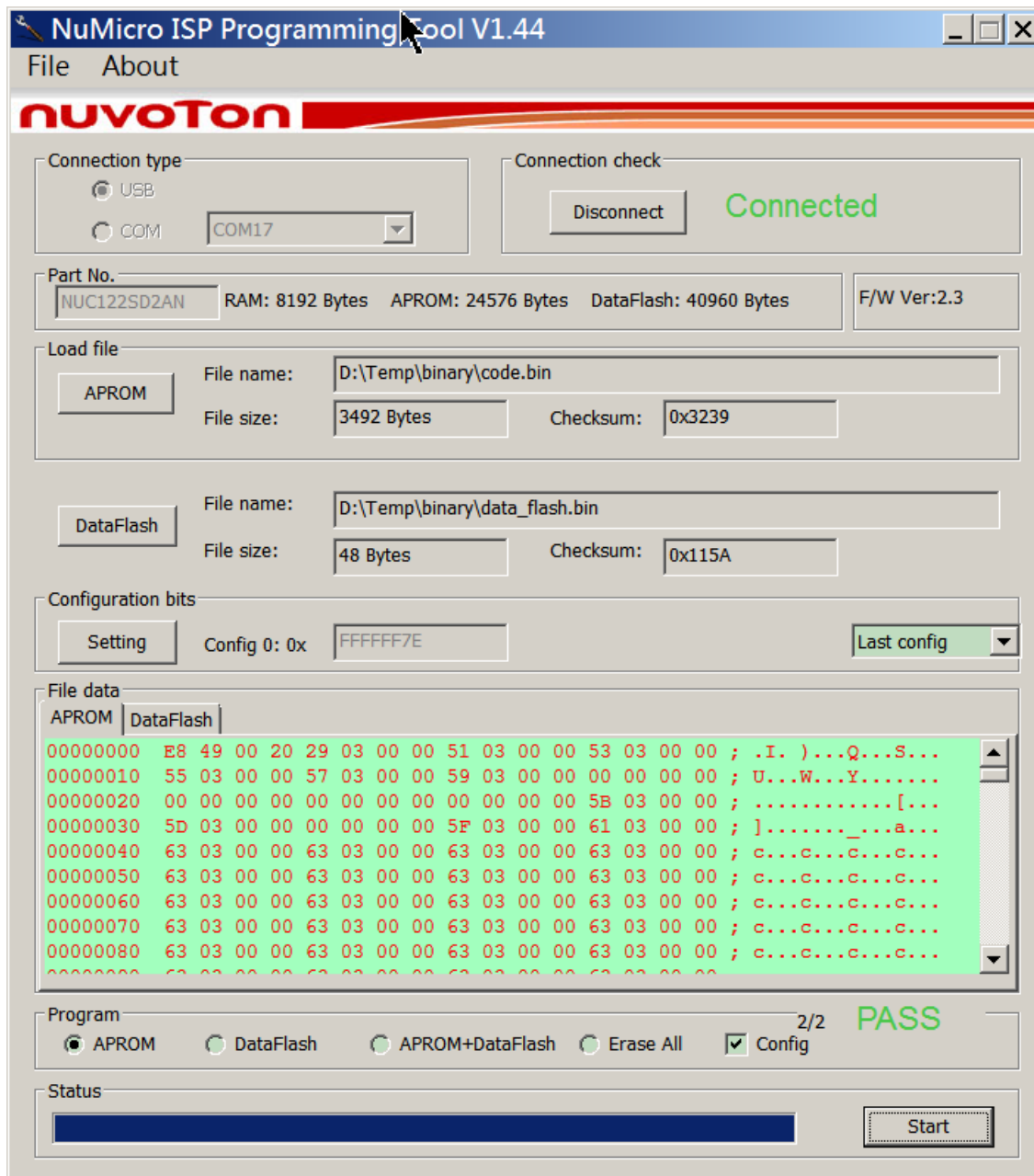


Figure 4-8 Program result

5 ISP Project File

ISP tool v1.44 or higher supports a project file with extension '.isp' which will help you to save the current settings such as connection type, file path, configuration bits value and programming type.

5.1 Save Project

To save project file is to record the current operation state. Click the "Save project" button in the "File" main menu, a file selection dialog will be pop-up. Select the target file path and press "OK" to save current state to the project file.

The project file records the current User Configuration, APROM image file path, Data Flash image file path, ISP connection port, APROM raw data, and Data Flash raw data.

5.2 Load Project

User can load the previous operation state from the project file. User Configuration will be loaded from project file. APROM raw data image and Data Flash raw data image will be loaded from project file. The file path of APROM image and Data Flash image will also be loaded.

User may save the project in one computer and then copy the project file to another computer to load it. It's possible that the later computer does not have APROM or Data Flash image files in the file path recorded by project file. Or the APROM and Data Flash image file in different from the former one. To avoid such inconsistency, ISP tool always load APROM and Data Flash raw data images from project file and does not read images from local image files. If user want to use local file images, he must reselct APROM and Data Flash files from the ISP tool "APROM" and "DataFlash" button.

5.3 Auto Reload

The ISP tool can automatically remember the last operation state. On opening ISP tool, it will reload the last operation state automatically. It includes User Configuration, connection port, APROM image file path, and Data Flash file path. ISP tool will also load raw image data from APROM file and Data Flash file if they exist.

On ISP tool interface, user can select User Configuration setting from "Last config" and "On-Chip config". Where the "Last config" is the User Configuration setting of last operation state, while "On-Chip config" is the setting read from current connected Nuvoton chips.

6 Revision History

Revision	Date	Description
1.32	Dec. 08, 2010	The first formal released version.
1.40	Mar. 21, 2011	(1) The Nuvoton Standard ISP Code is updated to v2.3, which (i) Integrates 'ISP through COM port' and 'ISP through USB' functions for NUC120/140/101. (ii) Improve the operation stability. (2) Add 'Erase Flag' for erasing control of Data Flash during ISP operation. (3) Fix some application program bugs.
1.41	Apr. 29, 2011	Add support for ISP project file.
1.41.2	Aug. 29, 2011	Add support for Nano100 and Mini51 series
1.41.3	Nov. 17, 2011	Modify dataflash base address error for Nano100 and
1.42.1	Aug. 28, 2012	Add NUC123 support
1.44	Jan. 20, 2014	(1) Newly support Mini51BN, MINI51DE, M051CN, M051DE, NUC200, and Nano112 products. (2) Added User Configuration dialog for M051AN/BN, M051CN/DE, MINI51AN, MINI51BN, MINI51DE, Nano100 Series, Nano112 Series, NUC100 Series, NUC122 Series, NUC123 Series, and NUC200. (3) Project file includes APROM and Data Flash images file body, not only file path. (4) Remove "Erase Flag", which will cause Data Flash be erased. For this purpose, updated all ISP firmware to version 2.4. (5) Provide Nano112 ISP firmware.

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