

Nuvoton

8051 ISP by COM Port

User Manual

Revision 7.15, 2015/Apr/24

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Revision History

Revision	Description	Date
v1.00	The first released version.	2009/07/15
v5.00	(1) Improved data security of the <i>Nuvoton standard ISP code</i> for N78E366A, N78E055A, N78E059A and N78E517A. (Updated the ISP code version to v3.13.) (2) Updated the PC-site AP to v5.00. (The GUI display for "CONFIG Setting" becomes more user-friendly.)	2010/08/13
v5.02	(1) Fixed the HEX-to-BIN conversion error when the hex input file has a binary code size more than 64K. (The application program is updated to v5.02.) (2) Modified all the ISP code to prevent from hanging in LDROM when powered on in an RS-485 application. (Updated the ISP code version to v3.20.)	2010/11/15
v5.05	(1) Supported Tool Project (TPJ) file for management of GUI settings. (2) Fixed the ISP code bug when using 3.6864 MHz XTAL for 'ISP by COM Port' function. (Updated the ISP code version to v3.21.) (3) 3.6864 MHz is the lowest XTAL frequency instead of 3 MHz in v3.20.	2011/01/18
v5.31	(1) Fixed some software bugs. (2) Updated the ISP code version to v3.23.	2011/04/08
v5.50	(1) Supported N79E855/4/3, N79E845/4/3 and N79E815/4/3. (2) Updated the PC-site AP version to v5.50.	2011/06/15
v5.51	Fixed minor bugs in the PC-site AP of v5.50.	2011/07/26
v5.60	(1) Renamed the parts W78E051D~W78E516D. (2) Supported N79E8432 and N79E8132.	2011/10/20
v5.70	Supported N79A8211A.	2011/11/07
v6.00	(1) Supported production mode. (cf. Section 4.3) (2) Supported serial number programming. (cf. Section 7.1) (3) Supported fast protocol mode to reduce ISP operation time. (cf. Section 7.2) (4) Supported chip counter for successfully programmed chips. (cf. Section 7.3)	2011/12/26
v6.02	Fixed some minor software bugs.	2012/02/01
v6.04	Updated the document version to v6.03.	2012/02/29
v6.10	Updated the 'serial number programming' function. (cf. Section 7.1)	2012/03/26
v6.12	Fixed a software bug that makes "Auto Synchronization of Buffer Data" failed. (cf. Section 3.3)	2012/04/26
v7.10	Removed support for W78E051D, W78E(L)648, W78E(L)649, N79E813, N79E843, N79E853 and N79A8211A.	2014/01/15
v7.15	Supported N79E715, N76E885 and N76E616	2015/04/24

1 Introduction

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. For the 8051 MCU products, we provide an ISP solution through the COM port of PC. As long as the LDROM of the MCU is pre-programmed with the *Nuvoton Standard ISP Code* and CONFIG bits are properly configured, the user can easily update the APROM of the MCU through the COM port of PC.

Note:

The ISP function can work only when the ISP code has resided in LDROM of the MCU. To let users easily use the ISP function, some of the 8051 MCU products have the "Nuvoton Standard ISP Code" pre-programmed in LDROM and CONFIG bits properly configured before shipping. Please contact Nuvoton for detailed product information. (The "Nuvoton Standard ISP Code" is also included in the folder [(3) Nuvoton Standard ISP Code]. The user may program it with a universal programmer.)

2 Hardware

To make the 8051 MCU boot from LDROM after reset to run the ISP code, some specific I/O pins need to be tied to ground and the CONFIG needs to be properly configured. The following table shows the specific I/O pins and the proper CONFIG setting used for booting from LDROM after reset. In addition, to directly connect to the COM port of PC, there needs an RS232 transceiver (e.g. MAX232) in the target system. The following sub-sections will show the hardware connection.

I/O Pins and CONFIG Bit for Booting from LDROM after Reset

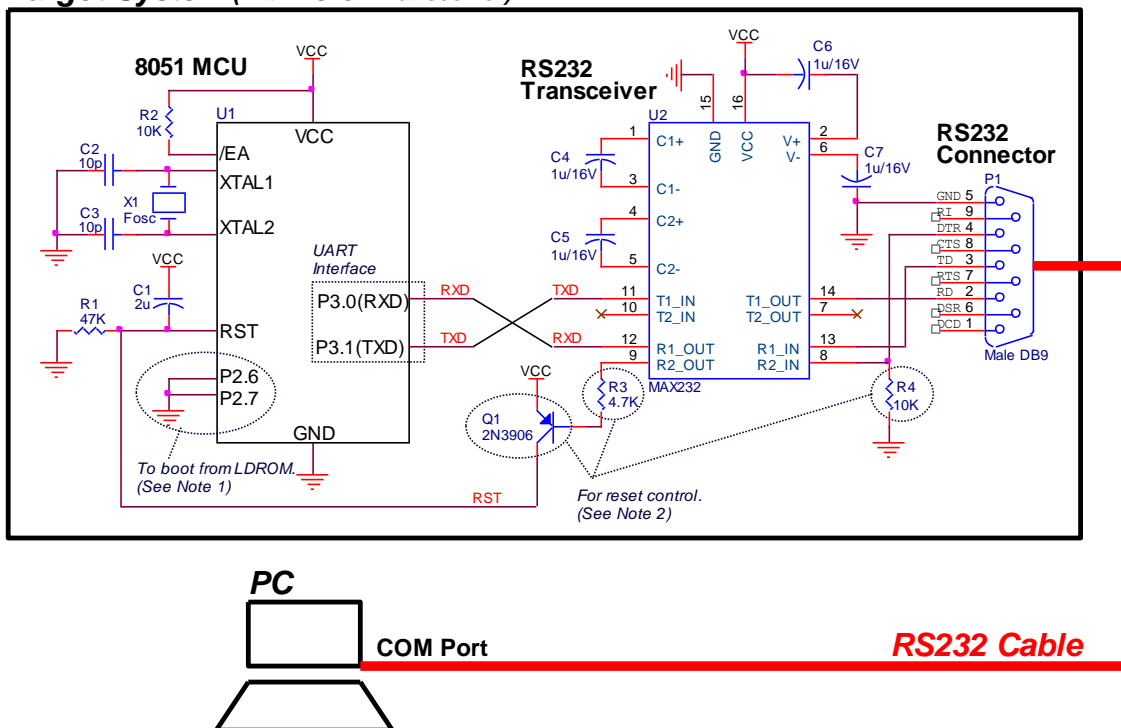
Part No.	I/O Pins Tied to Ground for Booting from LDROM	CONFIG Setting for Booting from LDROM
W78E052D W78E054D N78I054DFN	(Not Need)	'CBS' configured as LDROM
W78E058D W78E516D W78E(L)365A W78E065A W78E858A	P2.6 & P2.7 (for 40-pin package)	(Not Need)
	P4.3 (for 44-pin package)	(Not Need)
W78E(I)RD2A W77E(L)516A W77E(L)532A W79E(L)632A W79E(L)633A W79E(L)658A W79E(L)659A	P2.6 & P2.7 (for 40-pin package)	'Reboot P2.6/P2.7' configured as Enabled
	P4.3 (for 44/68/100-pin package)	'Reboot P4.3' Enabled
W79E217A W79E225A W79E226A W79E227A	P3.6 & P3.7 (for 44-pin package)	'Reboot P3.6/P3.7' configured as Enabled
	P4.3 (for 48/100-pin package)	'Reboot P4.3' configured as Enabled
W79E201A	P4.0	'Reboot P4.0' configured as Enabled
W925EP01	P4.7	'Reboot P4.7' configured as Enabled

Part No.	I/O Pins Tied to Ground for Booting from LDROM	CONFIG Setting for Booting from LDROM
N78E366A N78E055A N78E059A N78E517A N79E814A N79E815A N79E844A N79E845A N79E854A N79E855A N79E8132A N79E8432A N79E715 N76E885 N76E616	(Not Need)	'CBS' configured as LDROM

2.1 With an RS232 Transceiver in the Target System

In this design, each target system has an RS232 transceiver (e.g. MAX232) inside, and so only one RS232 cable is needed during the ISP operation, as shown below.

Target System (with RS232 Transceiver)



Note 1:

The I/O pins used for booting from LDRM may be P2.6&P2.7, P4.3, P3.6&P3.7, P4.0 or none.
(See the above table.)

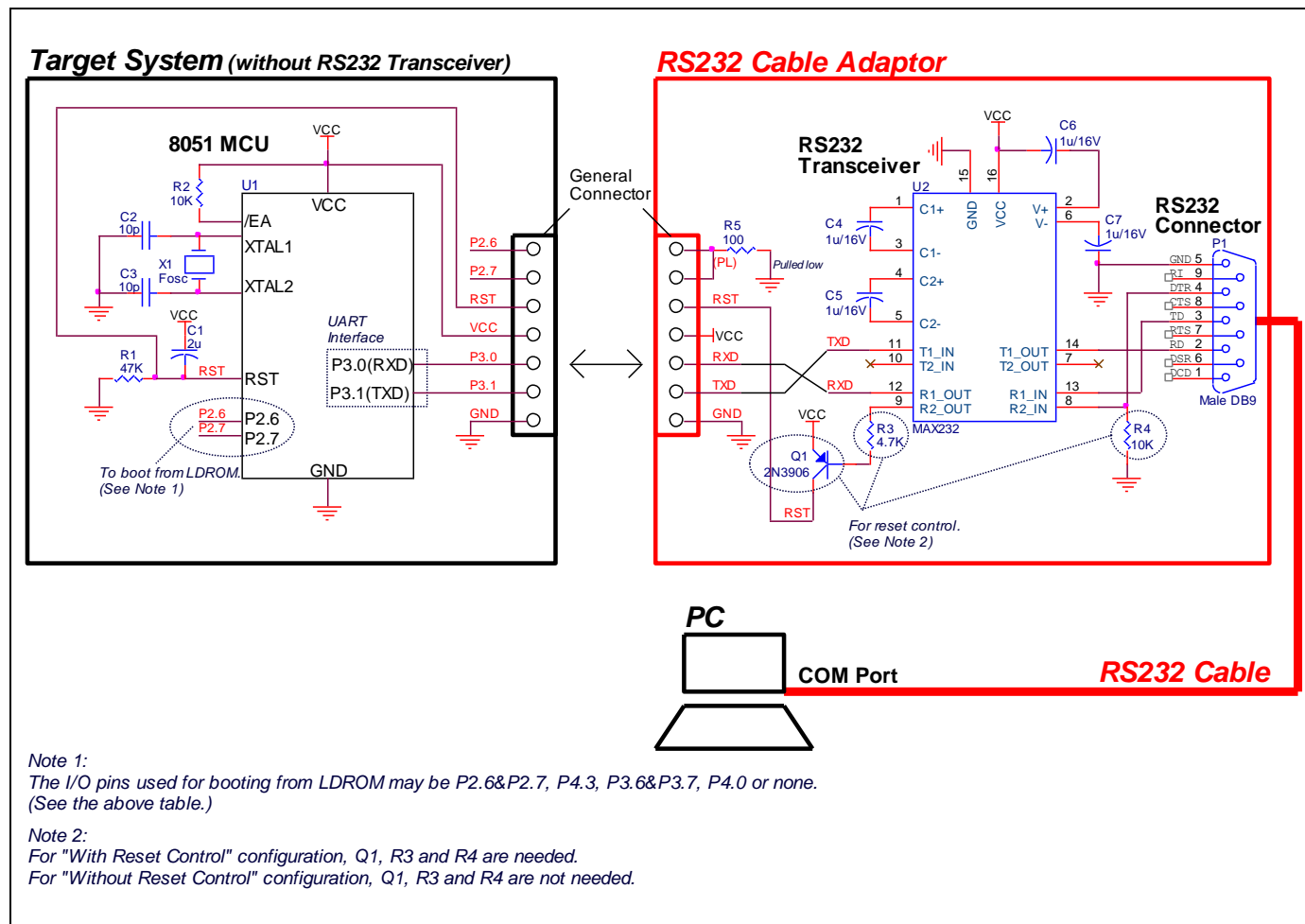
Note 2:

For "With Reset Control" configuration, Q1, R3 and R4 are needed.

For "Without Reset Control" configuration, Q1, R3 and R4 are not needed.

2.2 Without an RS232 Transceiver in the Target System

To save an RS232 transceiver (e.g. MAX232) built in each target system, the user may use the *RS232 Cable Adaptor* with an RS232 transceiver inside, as shown below.



2.3 Requirement on the MCU Operating Frequency

For ISP operation through COM port, there is no special restriction on the MCU operating frequency as long as the frequency is higher than or equal to 3.6864 MHz. The 8051 MCU will automatically choose a proper baudrate according to its operating frequency to communicate with the host (PC). It is recommended that the user uses the following specific frequencies: 3.6864 MHz, 11.0592 MHz, 18.432 MHz, 22.1184 MHz or 36.864 MHz, for the 8051 MCU to generate a standard baudrate. All the listed frequencies can be used to generate an exact baudrate of 115200bps, which will shorten the data transmission time during ISP operation.

3 Software

3.1 Installing the Application Program

The application program setup file is contained in the folder [(2) Application Program]. Using the default installation setting, you will find the item “Nuvoton Tools \ Nuvoton ISP-ICP Utility, v?.??” appears in the Windows START-menu after the application program is successfully installed.

Note:

‘ISP-ICP means’ this application program is used for both the ‘ISP’ Programmer and the ‘ICP Programmer’.
In addition, also for the ‘ISP by COM Port’.

3.2 Introduction to the GUI

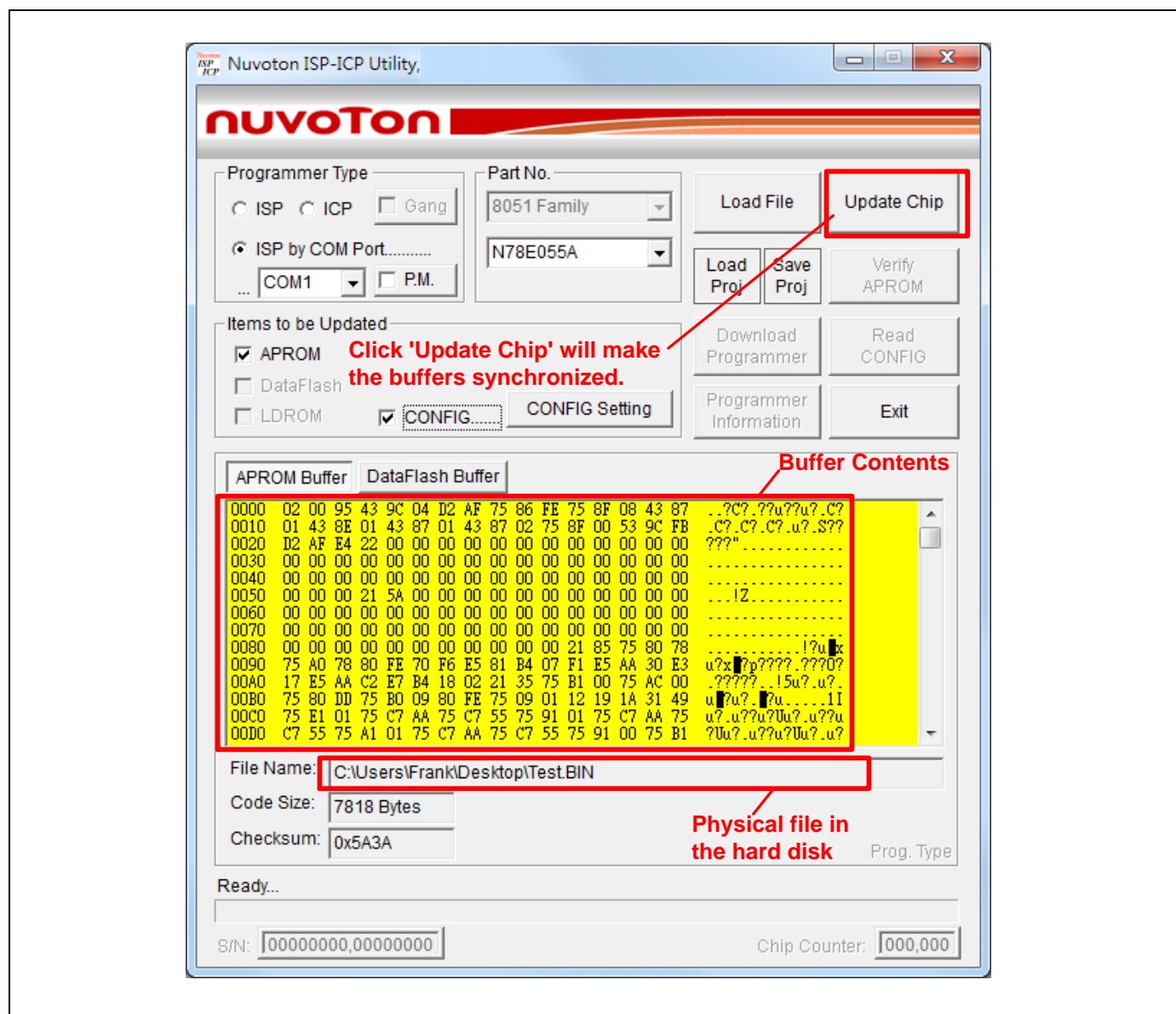
The screenshot shows the Nuvoton ISP-ICP Utility window. Red annotations with arrows point to specific features:

- Select 'ISP by COM Port'**: Points to the 'ISP by COM Port' radio button in the Programmer Type section.
- Select wanted Part No.**: Points to the 'Part No.' dropdown menu showing '8051 Family' and 'N78E055A'.
- Load file for APROM buffer and DataFlash buffer (See Note)**: Points to the 'Load File' button.
- Update the MCU chip**: Points to the 'Update Chip' button.
- Select the COM port to which the MCU chip is connected**: Points to the 'COM1' dropdown menu.
- Production Mode**: Points to the 'PM' checkbox.
- Set CONFIG bits**: Points to the 'CONFIG Setting' button.
- Select updated items when 'Update chip' is clicked**: Points to the 'Items to be Updated' section with checkboxes for APROM, DataFlash, and LDROM.
- Click to show APROM buffer**: Points to the 'APROM Buffer' tab.
- Click to show DataFlash buffer**: Points to the 'DataFlash Buffer' tab.
- Information of the loaded file**: Points to the 'File Name', 'Code Size', and 'Checksum' fields.
- Processing status**: Points to the 'Ready...' status bar.
- Serial number to be programmed**: Points to the 'S/N' field.
- Chip counter**: Points to the 'Chip Counter' field.

Note:
To load code file, click 'APROM Buffer', then click 'Load File'
To load data file, click 'DataFlash Buffer', then click 'Load File'

3.3 Auto Synchronization of Buffer Data

The buffer contents will be automatically synchronized with the physical file in the hard disk when the function button 'Update Chip' is clicked, as shown below. Thus, the user does not need to manually reload the files for APROM buffer and Data Flash buffer when the physical files are updated externally.



4 Operation Steps

4.1 With Reset Control

For the “With Reset Control” configuration, the user should follow the steps to do ISP.

Step 1: Connect the target system to the COM port of PC through an RS232 cable.

Step 2: Run the PC-site AP, select wanted part no., select correct COM port to which the target system is connected, and load the code/data file into APROM/Data Flash Buffer.

Step 3: Click the “Update Chip” button when the target system is in power-on state.

Step 4: Now, the 8051 MCU will automatically reboot from LDROM, and will be successfully detected and updated.

Note: If possible, “With Reset Control” is strongly recommended for ISP operation.

4.2 Without Reset Control

For the “Without Reset Control” configuration, the user should follow the steps to do ISP.

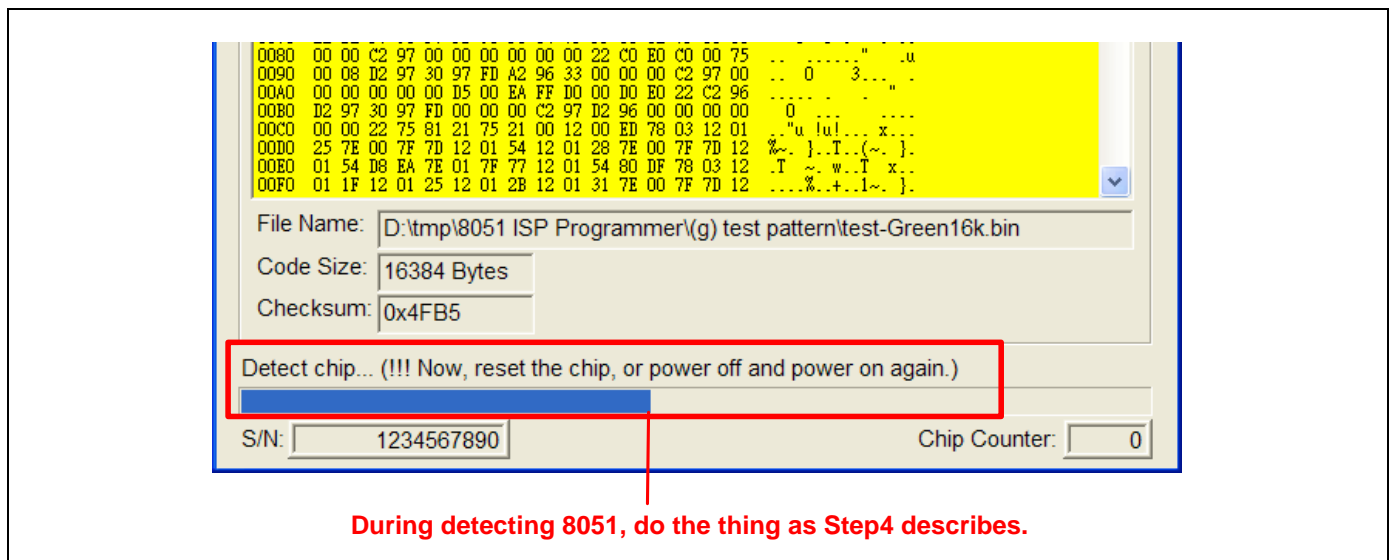
Step 1: Connect the target system to the COM port of PC through an RS232 cable.

Step 2: Run the PC-site AP, select wanted part no., select correct COM port to which the target system is connected, and load the code/data file into APROM/Data Flash Buffer.

Step 3: Click “Update Chip” button.

Step 4: Manually have the 8051 MCU reboot from LDROM during “Detect chip...”, as shown below, by the following two methods:

- (1) Send a reset pulse to the RST-pin of the MCU when the target system is in power-on state, or
- (2) Power off the target system and then power on again.



Step 5: Now, the 8051 MCU will be successfully detected and updated.

Note:

- (1) Step 4 shows the “Without Reset Control” is somewhat inconvenient for the user to have the 8051 MCU reboot from LDROM. This is why we strongly recommend the user to adopt the “With Reset Control” configuration.
- (2) If any failed condition happens, repeat steps 3 and 4.

4.3 Production Mode

In the production mode, the user should follow the steps to do ISP.

Step 1: Connect the target system to the COM port of PC through an RS232 cable.

Step 2: Run the PC-site AP, select wanted part no., select correct COM port to which the target system is connected, load the code/data file into APROM/Data Flash Buffer, and click the “**P.M.**” check box to enable production mode.

Step 3: Click the “Update Chip” button to start programming of production mode.

Step 4: Refer to Step 4 in Section 4.1 & 4.2 to make the 8051 MCU boot from LDROM.

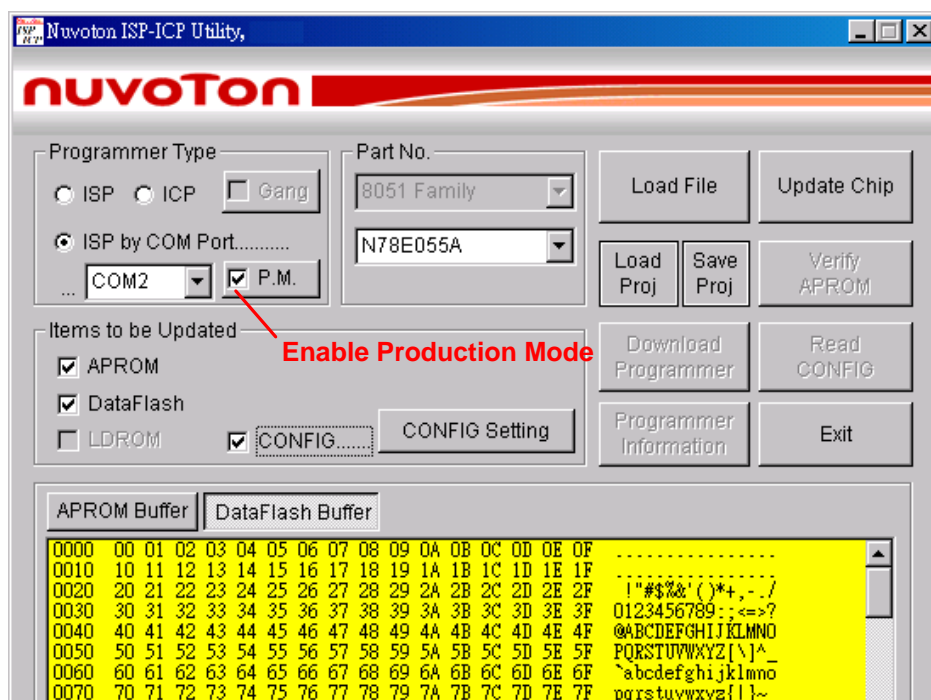
Step 5: The 8051 MCU will be detected and updated.

If pass, the ‘PASS’ message will be displayed for 1 second and then automatically disappear.

If fail, the ‘FAIL’ message will be displayed until the user closes it.

Step 6: Now, detecting 8051 MCU will automatically restart. The user may place the next chip to be programmed and go to Step 4.

To stop the production mode, click the ‘**P.M.**’ check box to be un-checked state.



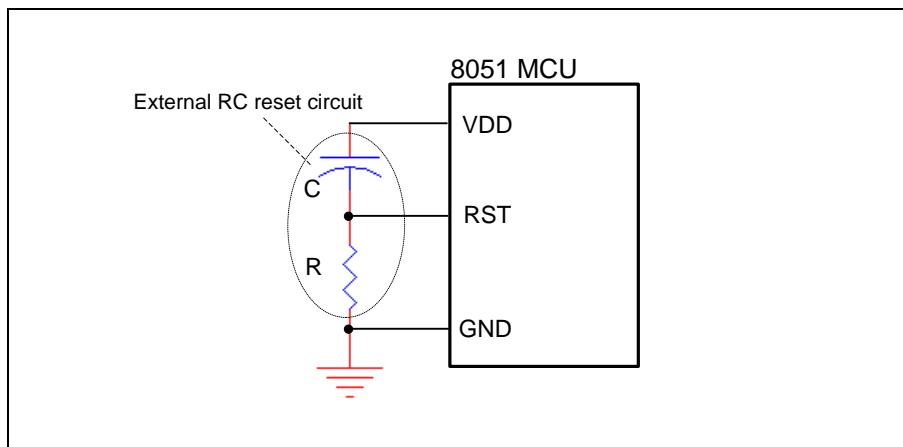
5 Reset Control

Normally, the RST-pin of the MCU with external RC reset circuit (see Figure 5a) can be controlled by the PNP transistor Q1 (see the figures in Sections 2.1 and 2.2). At this time, the user may adopt the “*With Reset Control*” configuration for ISP operation. However, the RST-pin cannot be controlled when it is connected to a reset IC (such as MAX810, ADM810, AIC810 and FP6810, etc., see Figure 5b). Now the user should adopt the “*Without Reset Control*” configuration for ISP operation.

External RC Reset Circuit

The general external RC reset circuit is shown in Figure 5a. The resistance of R should be larger than $47k\Omega$ to have the RST-pin be successfully controlled by the PNP transistor. Normally, $\{47k\Omega, 2.2\mu F\}$ and $\{100k\Omega, 1\mu F\}$ are recommended for $\{R, C\}$.

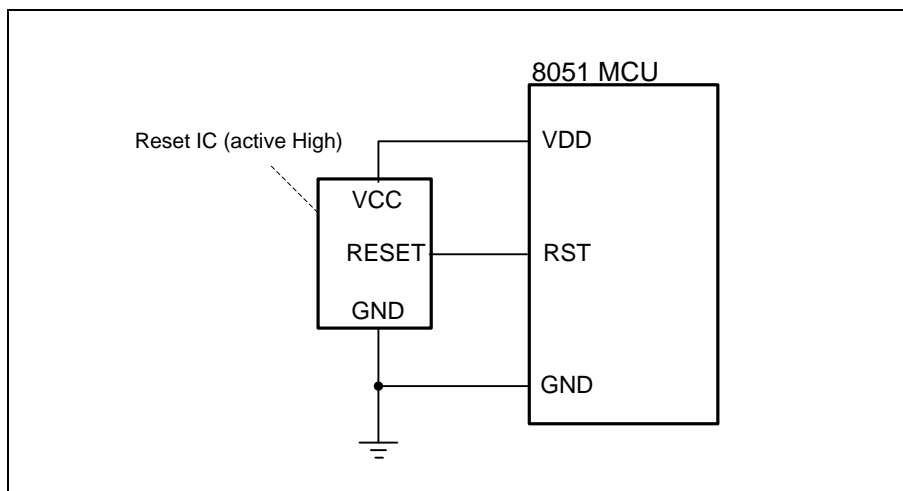
Figure 5a. External RC Reset Circuit



Reset Circuit with a Reset-IC

In this condition, the RST-pin cannot be controlled by the PNP transistor Q1.

Figure 5b. Reset Circuit with a Reset-IC

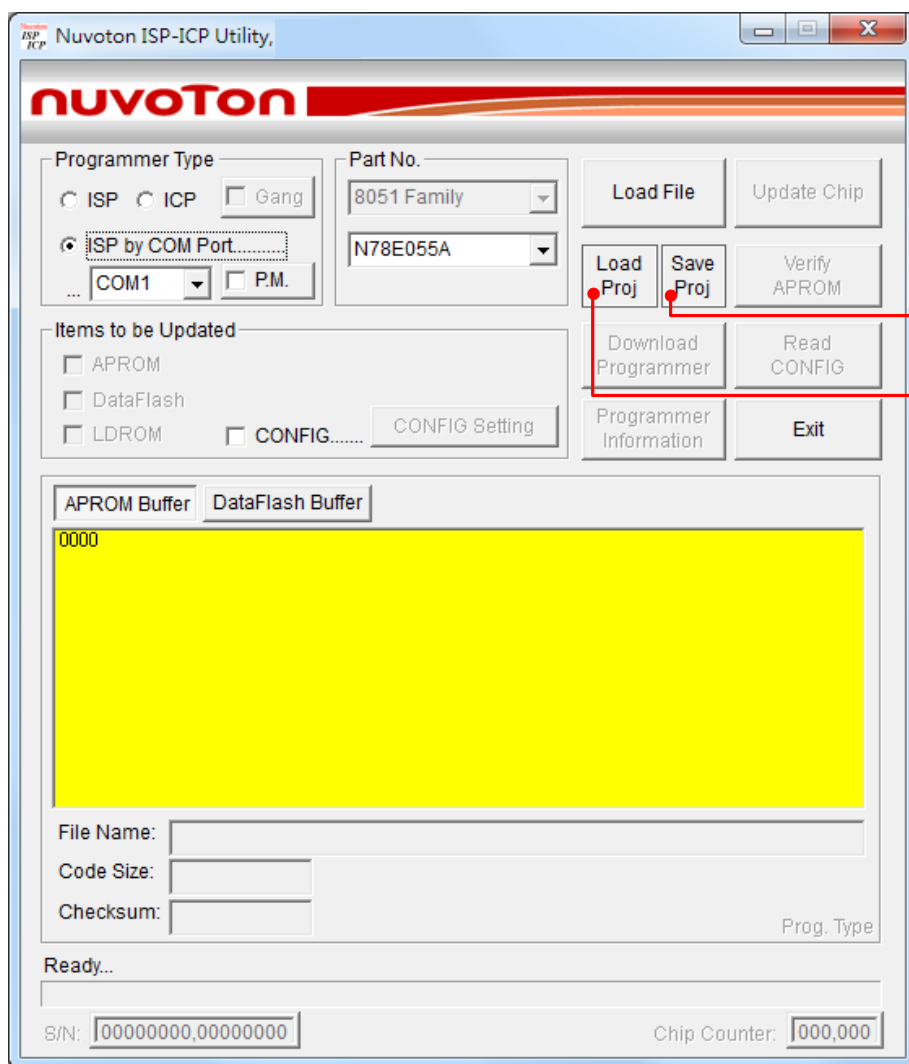


6 Tool Project File (TPJ)

The user may save all the GUI settings to the Tool Project (TPJ) file, and retrieve the GUI settings by loading the TPJ file previously saved. It is much helpful to the user to manage a variety of programming data by the 'project' type.

The GUI settings or the contents of the TPJ file include:

- (1) Programmer type
- (2) Part number
- (3) Items to be updated
- (4) APROM buffer data if APROM is one of the updated items
- (5) Data Flash buffer data if Data Flash is one of the updated items
- (6) CONFIG setting if CONFIG is one of the updated items
- (7) Advanced functions setting



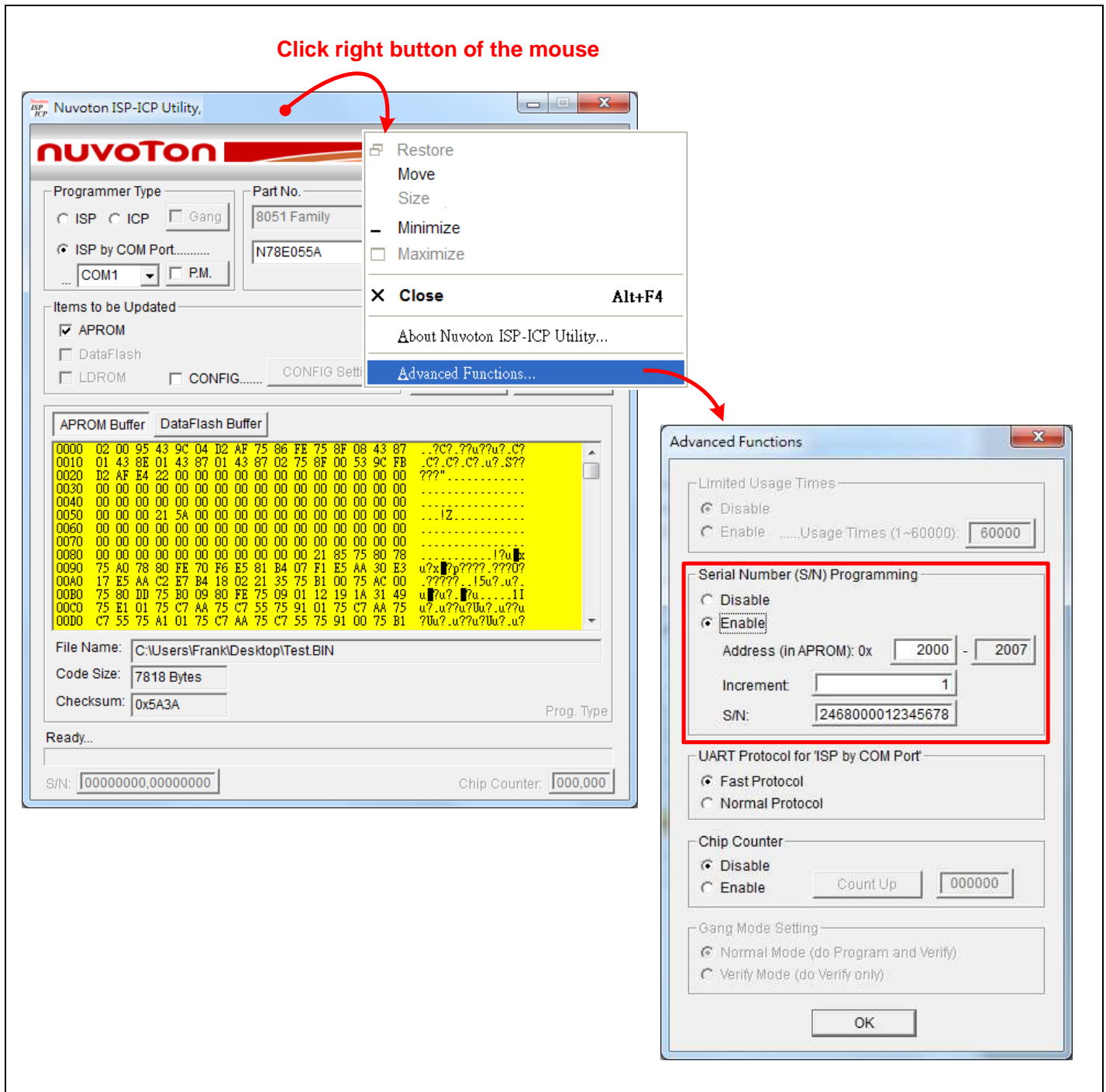
Save GUI setting
to a TPJ file

Restore GUI setting
from a TPJ file

7 Advanced Functions

7.1 Serial Number Programming

The serial number programming is supported in 'ISP by COM Port'. The serial number is BCD coded and 8 bytes long, which supports 16 decimal digits. Only APROM area can be programmed with the serial number. The following figure shows how to open the configuration dialog box for serial number programming.



As shown in the above figure, '2468000012345678' is to be programmed at address 0x3FF8 in APROM area. The BCD-coded serial number programmed in the chip has a 'what you see is what you get' format, as shown below.

00003F00:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F10:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F20:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F30:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F40:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F50:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F60:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F70:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F80:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003F90:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FA0:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FB0:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FC0:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FD0:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FE0:	FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF	YYYYYYYYYYYYYYYY
00003FF0:	FF FF FF FF FF FF FF FF 24 68 00 00 12 34 56 78	YYYYYYYY\$h..14Vx

@0x3FF8 @0x3FFF

7.2 Fast Protocol Mode

To greatly reduce the operation time of 'ISP by COM Port', the **Fast Protocol** mode is supported. In most conditions, the user can use this mode to do ISP. In some cases, for example, the XTAL frequency is 3.6864 MHz, the user may select the **Normal Protocol** mode to prevent communication problems from occurring during ISP operation.

Click right button of the mouse

The screenshot shows the Nuvoton ISP-ICP Utility window. A right-click context menu is open over the 'Advanced Functions...' button. The menu options are: Restore, Move, Size, Minimize, Maximize, Close (Alt+F4), About Nuvoton ISP-ICP Utility..., and Advanced Functions... (highlighted). The 'Advanced Functions' dialog is also shown, with the 'UART Protocol for ISP by COM Port' section highlighted in red. In this section, the 'Fast Protocol' radio button is selected.

Advanced Functions

- Limited Usage Times
 - ☒ Disable
 - ☐ EnableUsage Times (1~60000):
- Serial Number (S/N) Programming
 - ☒ Disable
 - ☐ Enable
 - Address (in APROM): 0x -
 - Increment:
 - S/N:
- UART Protocol for ISP by COM Port
 - ☒ Fast Protocol
 - ☐ Normal Protocol
- Chip Counter
 - ☒ Disable
 - ☐ Enable
- Gang Mode Setting
 - ☒ Normal Mode (do Program and Verify)
 - ☐ Verify Mode (do Verify only)

OK

7.3 Chip Counter

The chip counter is used to calculate the successfully programmed chips. The user may configure the counter as up counter or down counter, and set the initial counter value. The following figure shows how to open the configuration dialog box for chip counter.

