

Nuvoton

8051 ICP Programmer

User Manual

Revision 6.12, 2012/04/26

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Revision History

Revision	Description	Date
v3.00	The first formal released version.	2010/02/10
v4.00	(1) Add new parts: N79E234(R)/235(R) and N79E822A/823A/824A/825A. (2) Correct some GUI errors. (3) Update the document version to v4.00.	2010/04/01
v4.01	Update the document version to v4.01.	2010/04/30
v5.00	(1) Update the Hardware Connection. (Section 2.1) (2) Update the PC-site AP to v5.00. (The GUI display for "CONFIG Setting" becomes more user-friendly.)	2010/08/13
v5.02	Fix 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.)	2010/11/15
v5.05	(1) Support Tool Project (TPJ) file for management of GUI setting. (2) Release 'FS0' bit in CONFIG1 for W79E8213.	2011/01/18
v5.31	Fix some software bugs.	2011/04/08
v5.50	(1) Support N79E855/4/3, N79E845/4/3 and N79E815/4/3. (2) Support N79E375/374 and N79A903/902. (3) Support an advanced function: Limited Usage Times. (4) Update the PC-site AP version to v5.50.	2011/06/15
v5.51	Fix minor bugs in the PC-site AP of v5.50.	2011/07/26
v5.52	(1) Fix ICP programming problem of N79E855/4/3, N79E845/4/3 and N79E815/4/3 when VDD=3.3V. (2) The maximum 'Limited Usage Times' is changed from 9,999 to 60,000. (3) The 'Limited Usage Times' is also saved when saving the TPJ file.	2011/09/28
v5.60	Support N79E8432 and N79E8132.	2011/10/20
v5.70	Support N79A8211A.	2011/11/07
v6.00	Support chip counter for successfully programmed chips. (cf. Section 7.2)	2011/12/20
v6.02	Fix some minor software bugs.	2012/02/01
v6.03	Nothing changed but updating the document version to v6.03.	2012/02/13
v6.04	Fix ICP programming problem in the following parts: N79E855/4/3, N79E845/4/3, N79E815/4/3, N79E8432 and N79E8132.	2012/02/29
v6.10	Support 'serial number programming' function. (cf. Section 7.2)	2012/03/26
v6.12	Fix a software bug that sometimes makes "Auto Synchronization of Buffer Data" failed. (cf. Section 3.4)	2012/04/26

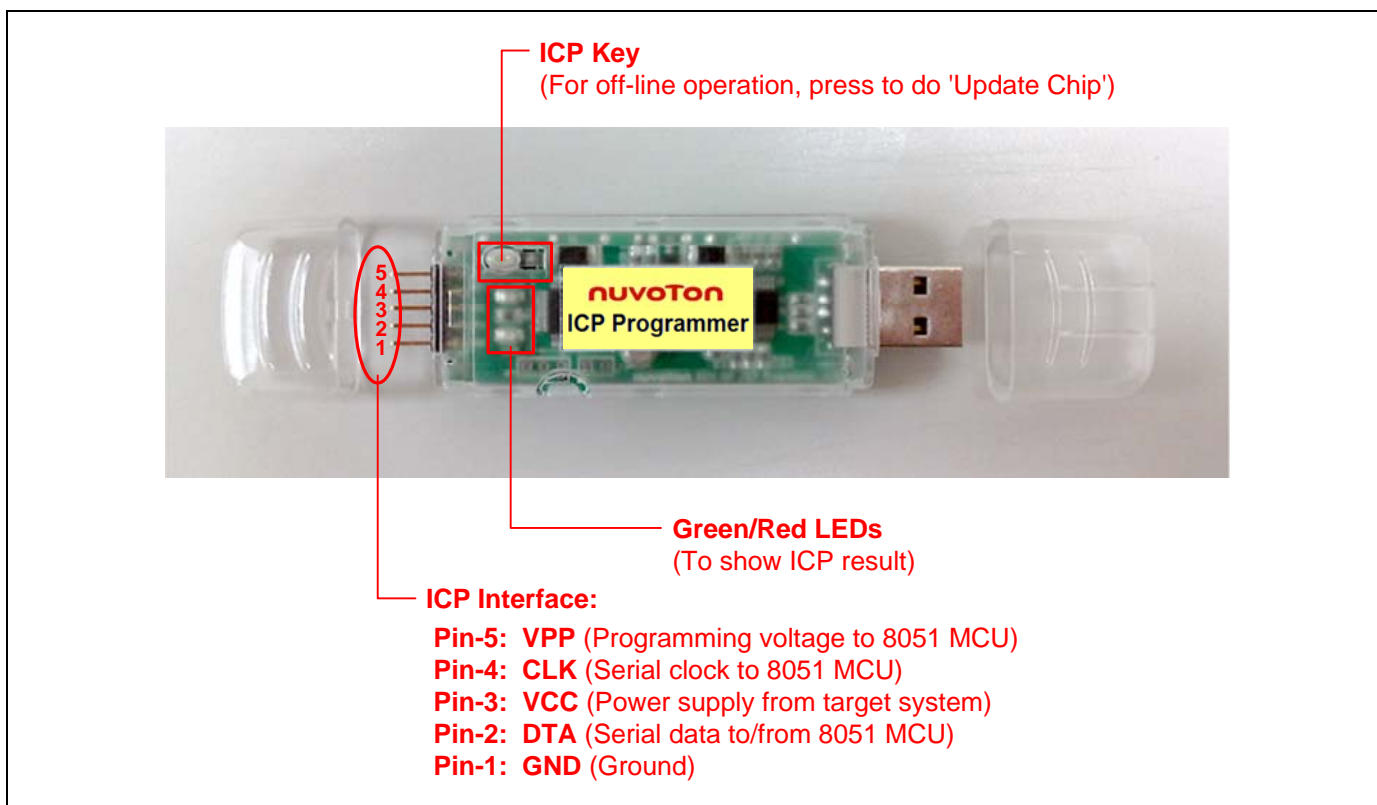
1 Introduction

ICP is the acronym of **In-Circuit Programming**, which makes it possible that the user can update the MCU's program memory under the hardware control without removing the mounted MCU chip from the actual end product. The USB-stick-like tool "8051 ICP Programmer", as shown in the following picture, is used to perform the ICP function. It uses a serial interface with only five pins for programming, not like the universal programmer, which usually uses a parallel interface. In addition, since this tool can save the programming data downloaded from the host, it is able to perform the off-line operation. This feature is especially useful in the field without a host.

Note:

The difference between ICP (In-Circuit Programming) and ISP (In-System Programming) is that ICP is implemented by hardware control while ISP is implemented by software control of MCU itself. So, before updating the MCU chip, ISP needs a software code (the ISP-code) pre-programmed in MCU's LDRAM to function as software control while ICP doesn't need any software code pre-programmed.

Picture of the "8051 ICP Programmer"



The ICP Interface

VPP: Programming voltage to the 8051 MCU. This voltage may be up to +11V for some MCU parts.

CLK: Serial clock to the 8051 MCU.

VCC: Power supply from the target system. In off-line operation, the Programmer is powered by the target system.

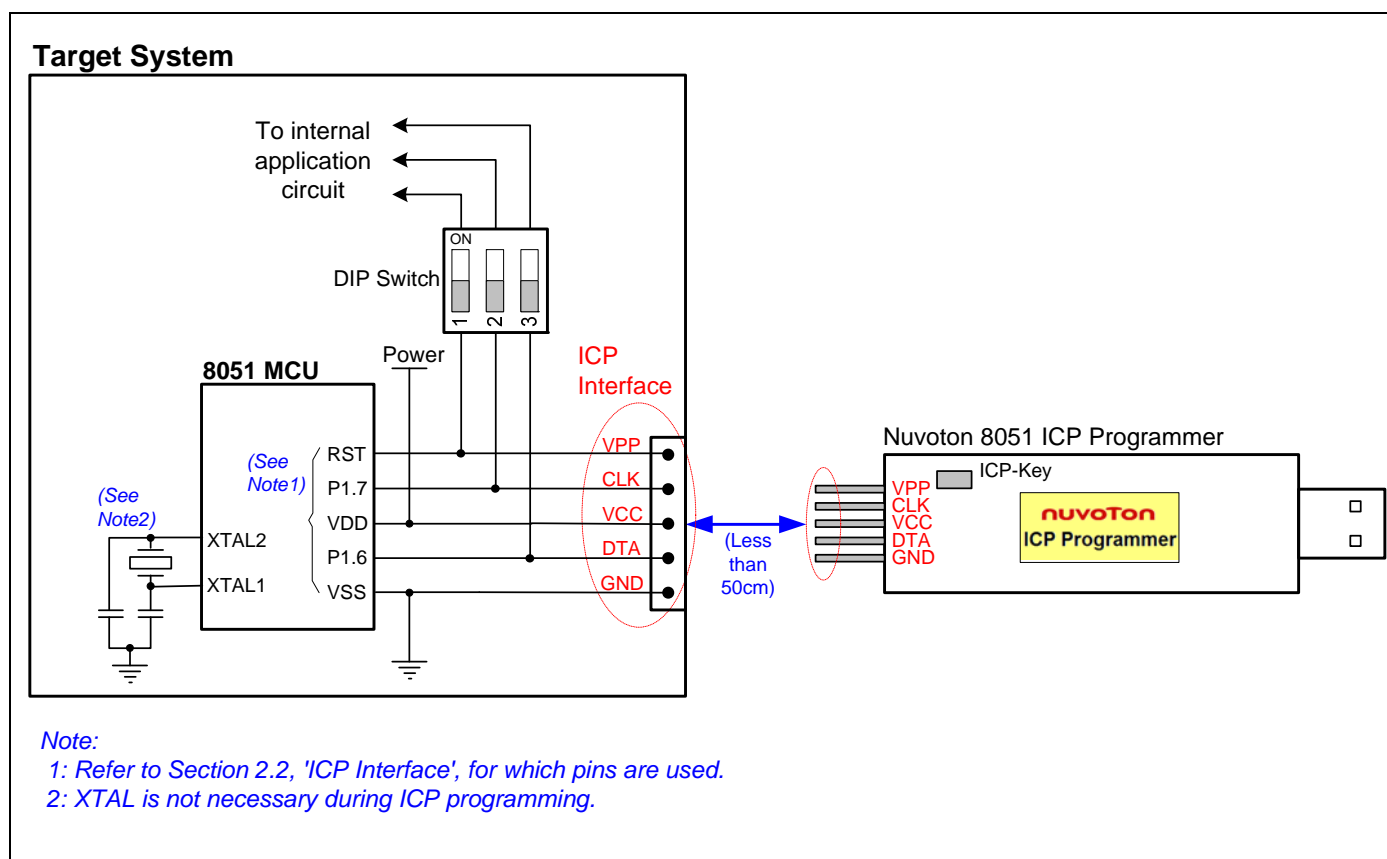
DTA: Serial data to/from the 8051 MCU.

GND: Ground.

2 Hardware

2.1 Hardware Connection

The following diagram shows the hardware connection. The DIP-switch is recommend to isolate the ICP interface signals from the application circuit during ICP programming. Before starting ICP programming, the user should switch the DIP-switch to OFF state. Note the DTA and CLK signals are always kept at TTL level while the VPP signal may rise up to +11V for some parts. For the parts with VPP up to +11V, the isolation is especially necessary to protect the application circuit from being damaged. After ICP programming is finished, disconnect the ICP Programmer and switch the DIP-switch to ON state for normal operation.



2.2 ICP Interface

See the following table for the pins used as the ICP interface.

Part No.	Pins Used as the ICP Interface			+11V for VPP
	DTA	CLK	VPP	
W79E802A	P0.4	P0.5	P1.5	YES
W79E803A	P0.4	P0.5	P1.5	YES
W79E804A	P0.4	P0.5	P1.5	YES
W79E822B	P0.4	P0.5	P1.5	YES
W79E823B	P0.4	P0.5	P1.5	YES
W79E824A	P0.4	P0.5	P1.5	YES
W79E825A	P0.4	P0.5	P1.5	YES
W79E832A	P0.4	P0.5	P1.5	YES
W79E833A	P0.4	P0.5	P1.5	YES
W79E834A	P0.4	P0.5	P1.5	YES
W79E2051A	P1.6	P1.7	RST	NO
W79E2051RA	P1.6	P1.7	RST	NO
W79E4051A	P1.6	P1.7	RST	NO
W79E4051RA	P1.6	P1.7	RST	NO
W79E8213	P0.4	P0.5	P1.5	YES
W79E8213R	P0.4	P0.5	P1.5	YES
N79E342	P0.4	P0.5	P1.5	YES
N79E342R	P0.4	P0.5	P1.5	YES
N79E352	P1.6	P1.7	RST	NO
N79E352R	P1.6	P1.7	RST	NO
N79E875	P0.4	P0.5	P1.4	YES
N79E875R	P0.4	P0.5	P1.4	YES
N79E234	P0.4	P0.5	P1.4	YES
N79E234R	P0.4	P0.5	P1.4	YES
N79E235	P0.4	P0.5	P1.4	YES
N79E235R	P0.4	P0.5	P1.4	YES
N79E822A	P0.4	P0.5	P1.5	YES
N79E823A	P0.4	P0.5	P1.5	YES
N79E824A	P0.4	P0.5	P1.5	YES
N79E825A	P0.4	P0.5	P1.5	YES

Part No.	Pins Used as the ICP Interface			+11V for VPP
	DTA	CLK	VPP	
N79E813A	P1.6	P1.7	/RST	NO
N79E814A	P1.6	P1.7	/RST	NO
N79E815A	P1.6	P1.7	/RST	NO
N79E843A	P1.6	P1.7	/RST	NO
N79E844A	P1.6	P1.7	/RST	NO
N79E845A	P1.6	P1.7	/RST	NO
N79E853A	P1.6	P1.7	/RST	NO
N79E854A	P1.6	P1.7	/RST	NO
N79E855A	P1.6	P1.7	/RST	NO
N79E8132A	P1.6	P1.7	/RST	NO
N79E8432A	P1.6	P1.7	/RST	NO
N79E374A	ICPDA	ICPCK	RST	NO
N79E375A	ICPDA	ICPCK	RST	NO
N79A8211A	P1.6	P1.7	/RST	NO

3 Software

3.1 Installation of Driver

This ICP Programmer has the USB-to-Serial bridge chip (PL-2303) built inside. When connected to host, it will appear as a *USB-to-Serial COM port* in the System\Hardware\Device Manager. Before starting to use this programmer, the user has to install the driver if the PL-2303 driver has never been installed in this host. The user can also find this driver in the folder [(1) Driver].

Note: Don't plug the ICP Programmer to the host before the driver is installed.

3.2 Installation of 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?..???" appearing in the Windows START-menu after the application program is successfully installed.

Note: ISP-ICP means this application program is designed for both the ISP Programmer and the ICP Programmer.

3.3 Introduction to the GUI

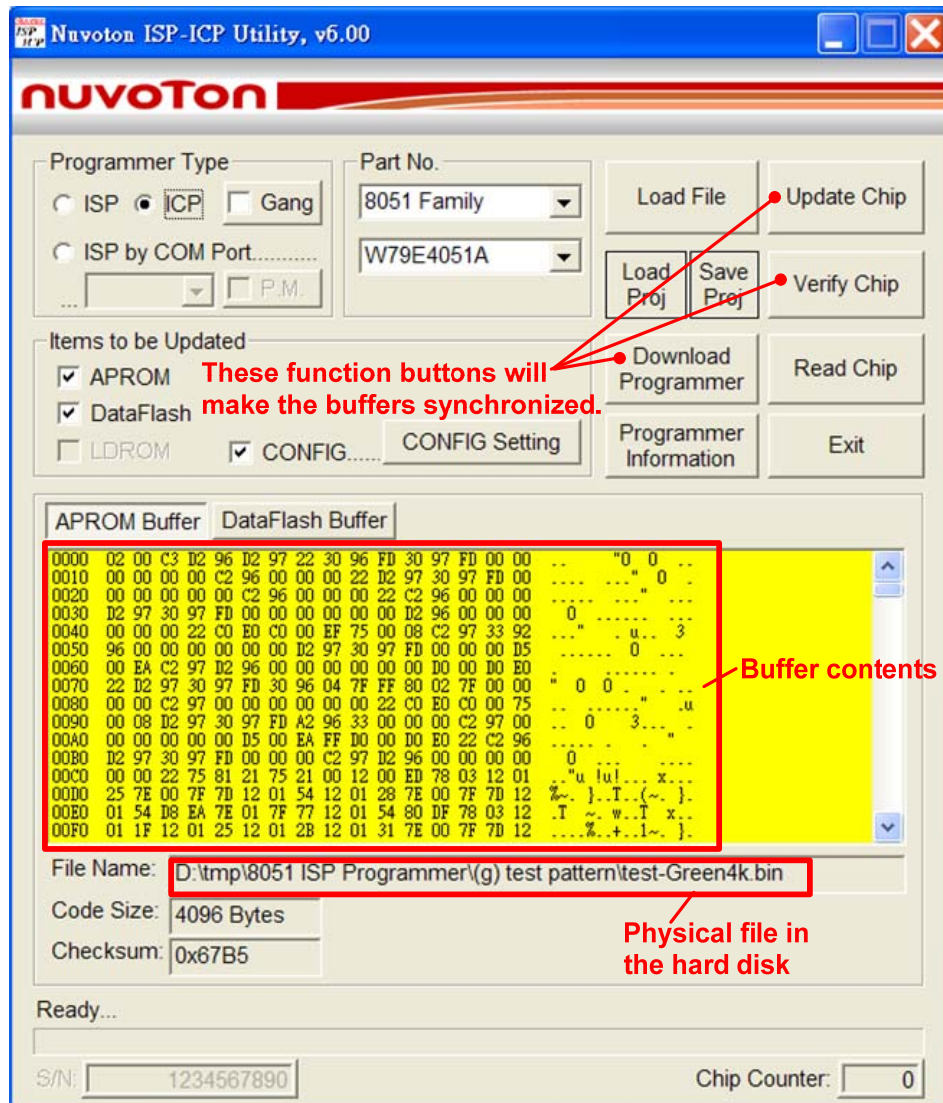
The screenshot shows the Nuvoton ISP-ICP Utility v6.12 GUI. Red arrows and text labels point to various interface elements:

- Select 'ICP' for the ICP Programmer:** Points to the 'ICP' radio button under 'Programmer Type'.
- Select wanted Part No.:** Points to the 'Part No.' dropdown menu showing '8051 Family' and 'W79E4051A'.
- Load file for APROM buffer and DataFlash buffer (See Note):** Points to the 'Load File' button.
- Two things included: (1) Download Programmer (2) Update the MCU chip:** Points to the 'Update Chip' button.
- Compare the MCU chip's contents with the loaded data in the buffers:** Points to the 'Verify Chip' button.
- Show the MCU chip's contents:** Points to the 'Read Chip' button.
- Download the current GUI setting and buffer data into the programmer:** Points to the 'Download Programmer' button.
- Show the programming data downloaded in the programmer:** Points to the 'Programmer Information' button.
- Select updated items when 'Update Chip' is clicked:** Points to the 'Items to be Updated' section, which includes checkboxes for 'APROM', 'DataFlash', 'LDROM', and 'CONFIG'.
- Set CONFIG bits:** Points to the 'CONFIG Setting' button.
- 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.
- S/N to be programmed:** Points to the 'S/N' field showing '00000000,12345678'.
- Chip counter:** Points to the 'Chip Counter' field showing '000,000'.

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

3.4 Auto Synchronization of Buffer Data

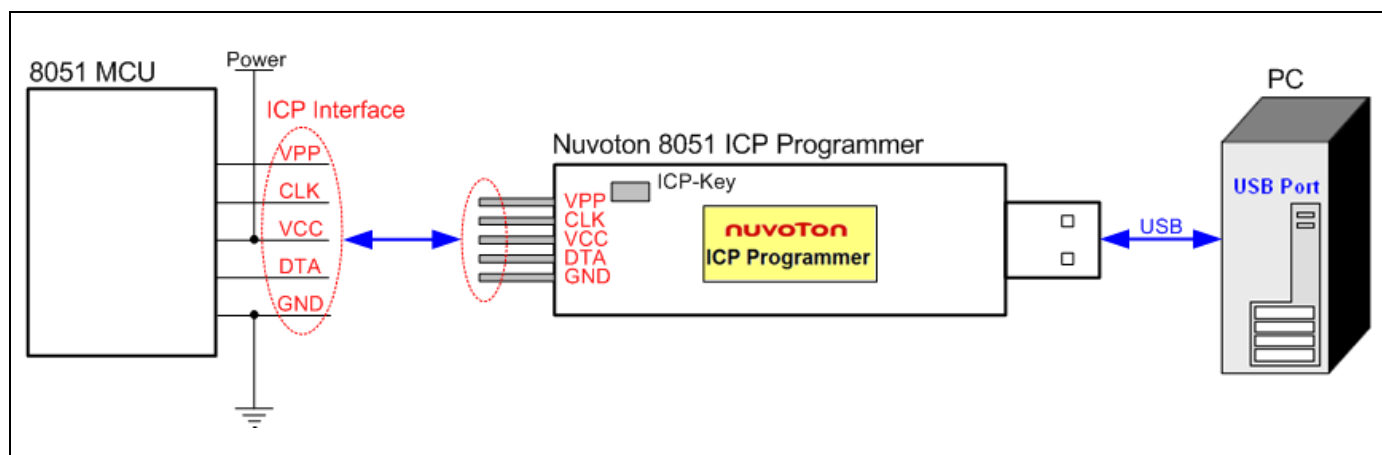
The buffer contents will be automatically synchronized with the physical file in the hard disk when the function buttons 'Download Programmer', 'Update Chip' or 'Verify Chip' are clicked, as shown below. So, the user needn't manually reload the files for APROM buffer and DataFlash buffer when the physical files are updated externally.



4 Operation Modes

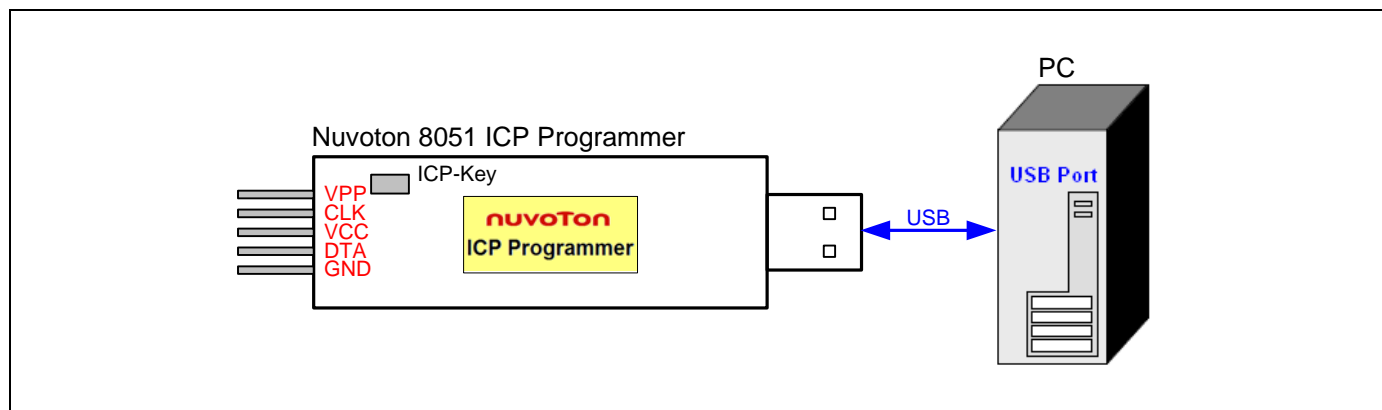
4.1 On-line Mode

The system diagram for **On-line Mode** is shown below. In this mode, both the host and MCU chip are connected. The user may directly update the MCU chip or download the programming data into the programmer for use in the Off-line Mode. After updating the MCU chip, the user may disconnect the programmer and send a reset signal to the MCU chip to make it re-start to run the new application code.



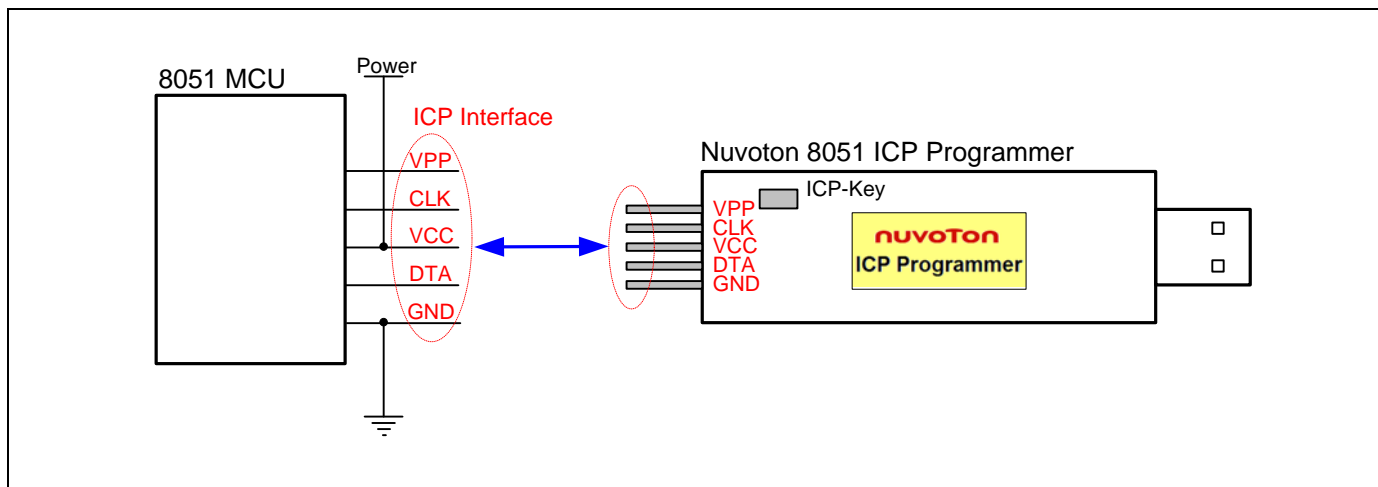
4.2 Download Programmer Mode

The system diagram for **Download Programmer Mode** is shown below. In this mode, only the host is connected. The user may download the programming data into the programmer for use in the Off-line Mode.



4.3 Off-line Mode

The system diagram for **Off-line Mode** is shown below. In this mode, only the MCU chip is connected. This mode is especially useful in the field without a PC. After the programmer has been downloaded, it can perform the off-line operation. Press the ICP-Key to start an ICP operation to update the MCU chip. After updating the MCU chip, the user may disconnect the programmer and send a reset signal to the MCU chip to make it run the new application code.

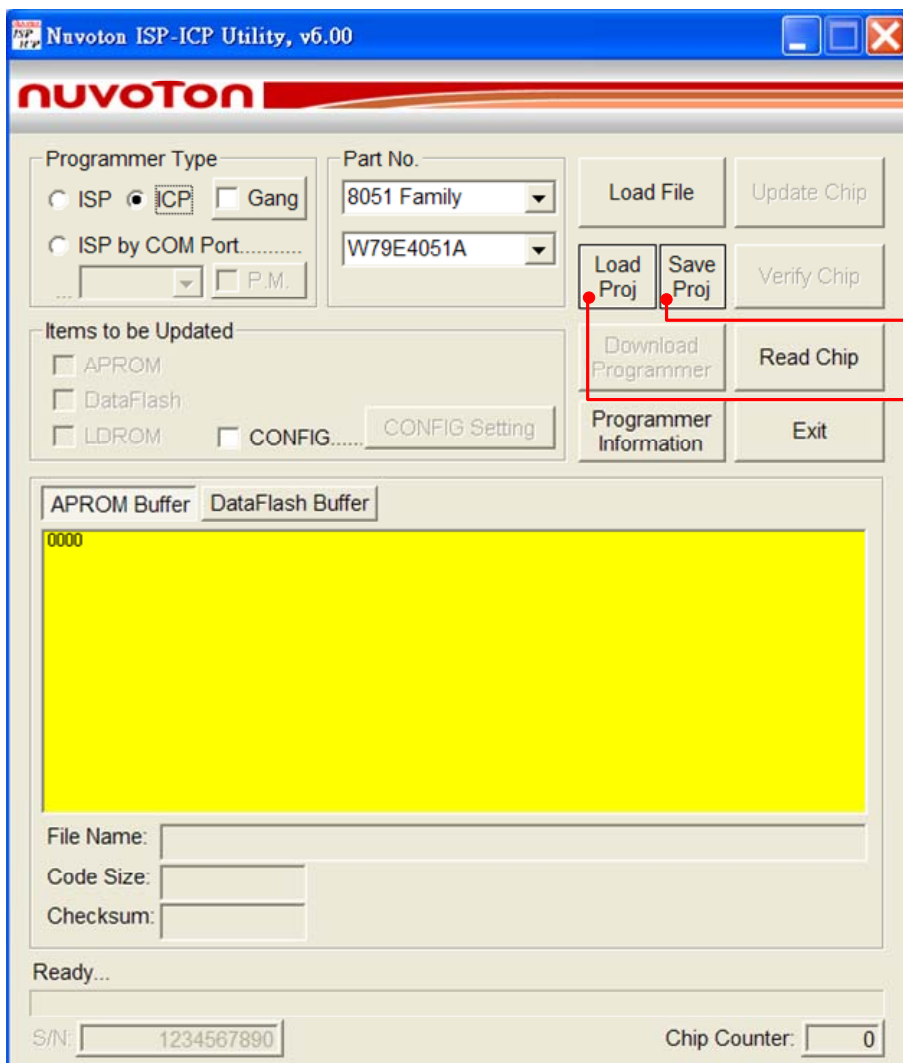


5 Tool Project File (TPJ)

The user may save all the GUI setting to the Tool Project (TPJ) file, and retrieve the GUI setting 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 setting or the contents of the TPJ file include:

- (1) The programmer type
- (2) The part number
- (3) The items to be updated
- (4) The APROM buffer data if APROM is one of the updated items
- (5) The DataFlash buffer data if DataFlash is one of the updated items
- (6) The LDROM buffer data if LDROM is one of the updated items
- (7) The CONFIG setting if CONFIG is one of the updated items
- (8) The advanced functions setting

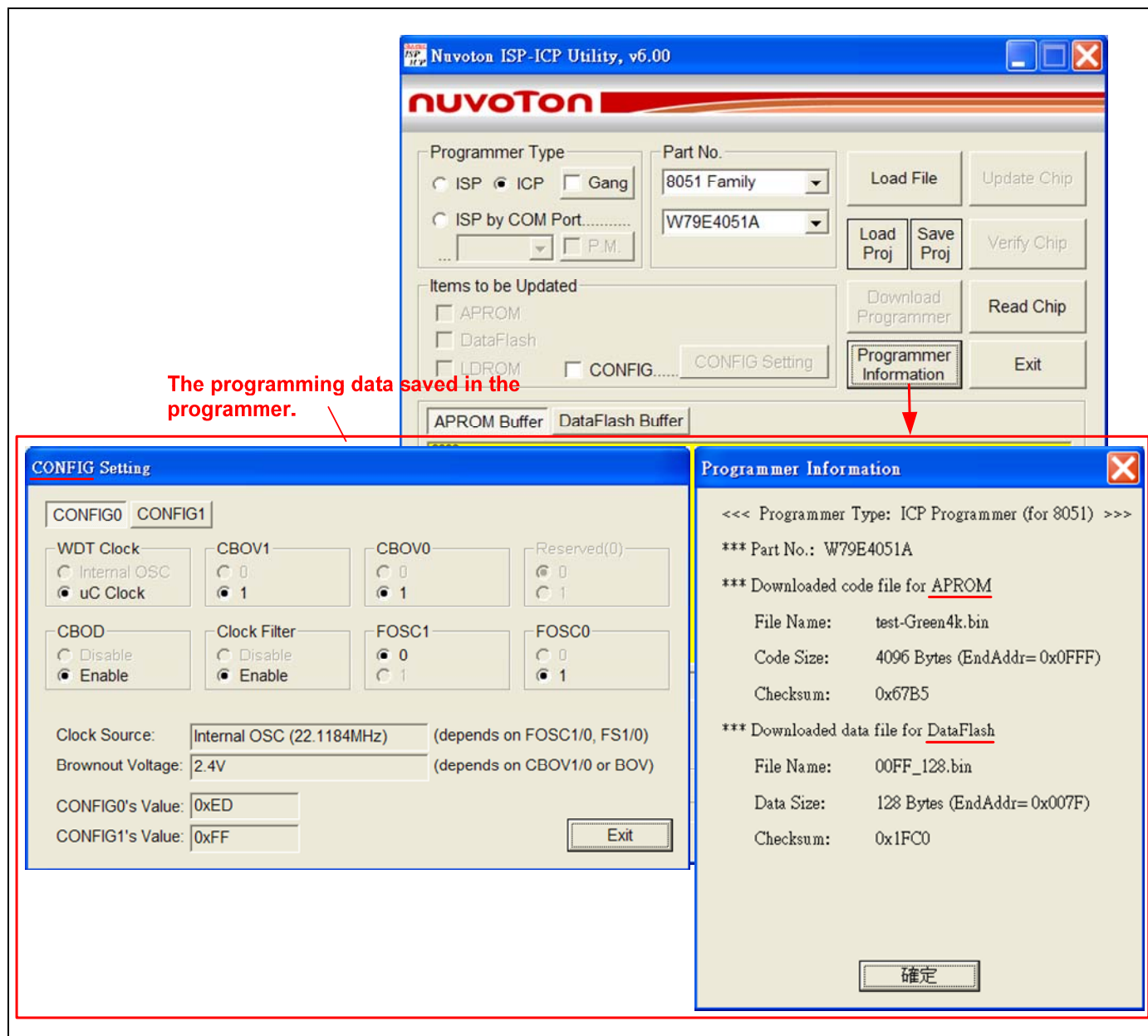


Save GUI setting
to a TPJ file

Restore GUI setting
from a TPJ file

6 Programmer Information

To check the programming data downloaded in the Programmer, click the 'Programmer Information' button when the Programmer is connected to PC. Note the 'CONFIG Setting' dialog box appears only when the CONFIG bits are to be updated.



7 Advanced Functions

7.1 Limited Usage Times

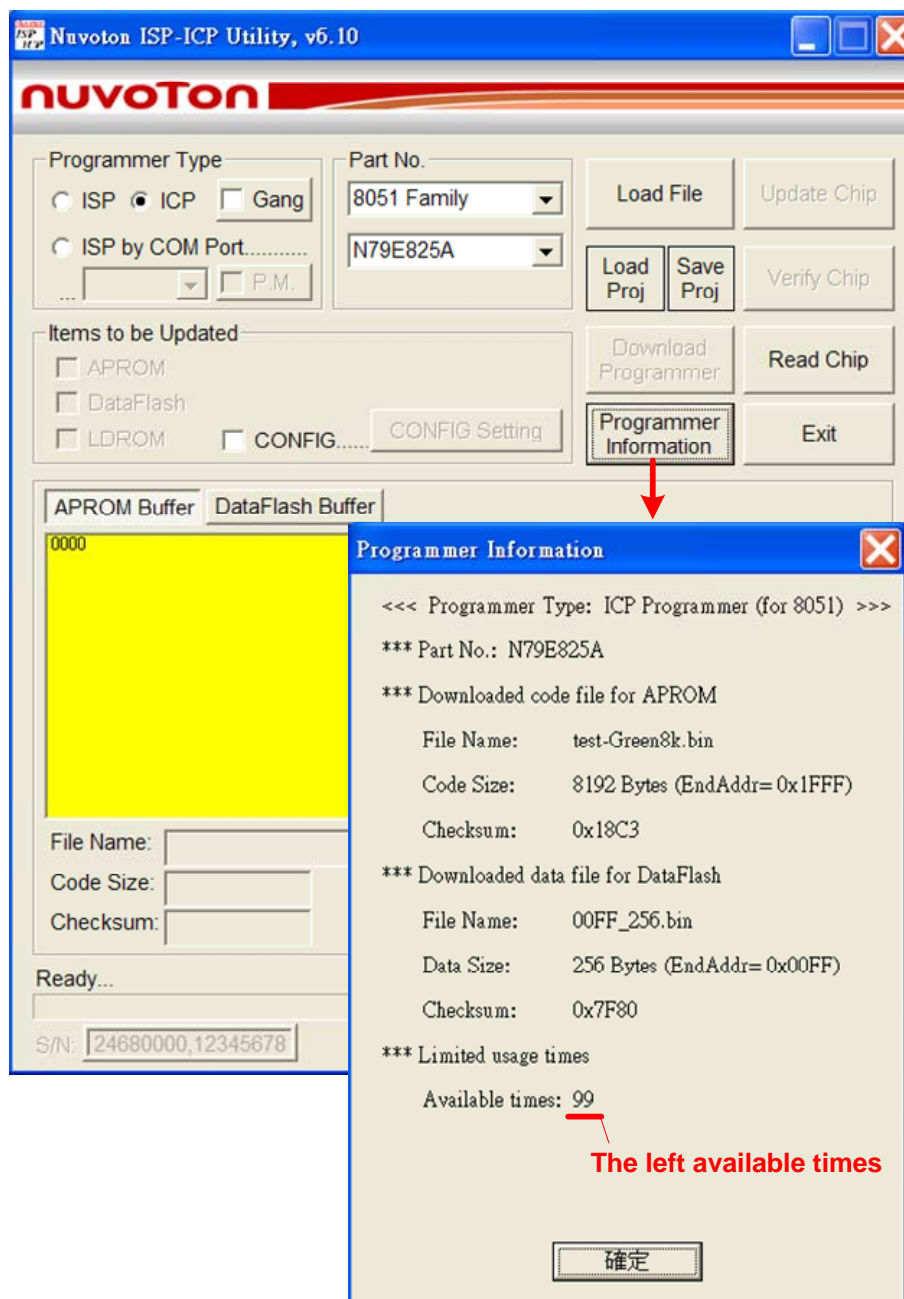
An advanced function, *Limited Usage Times*, is supported for the customer who wants to limit the usage times of the ICP Programmer. Once this function is enabled and the wanted times value is filled, as shown below, the usage times of this programmer will be limited after finishing 'Download Programmer'. Provided that 100 is filled, then the programmer will be no longer available when reaching 100 times of successful programming. That is to say, only 100 times of successful programming are available.

Click right button of the mouse

The screenshot displays the Nuvoton ISP-ICP Utility v6.10 interface. A right-click context menu is open over the 'Advanced Functions...' button. The 'Advanced Functions' dialog box is shown, with the 'Limited Usage Times' section highlighted by a red rectangle. In this section, the 'Enable' radio button is selected, and the 'Usage Times (1~60000)' is set to 100. Other sections in the dialog include 'Serial Number (S/N) Programming' (set to 'Disable'), 'UART Protocol for 'ISP by COM Port'' (set to 'Fast Protocol'), 'Chip Counter' (set to 'Disable'), and 'Gang Mode Setting' (set to 'Normal Mode (do Program and Verify)'). The main window shows the 'Programmer Type' set to 'ICP', 'Part No.' as '8051 Family', and 'Items to be Updated' including 'APROM', 'DataFlash', and 'CONFIG'. The 'APROM Buffer' and 'DataFlash Buffer' sections show memory addresses and data. The 'File Name' is 'D:\tmp\8051 ISP Programmer\g) test pattern\test-Green8k.bin', 'Code Size' is '8192 Bytes', and 'Checksum' is '0x18C3'. The 'S/N' is '24680000,12345678' and 'Chip Counter' is '000,000'.

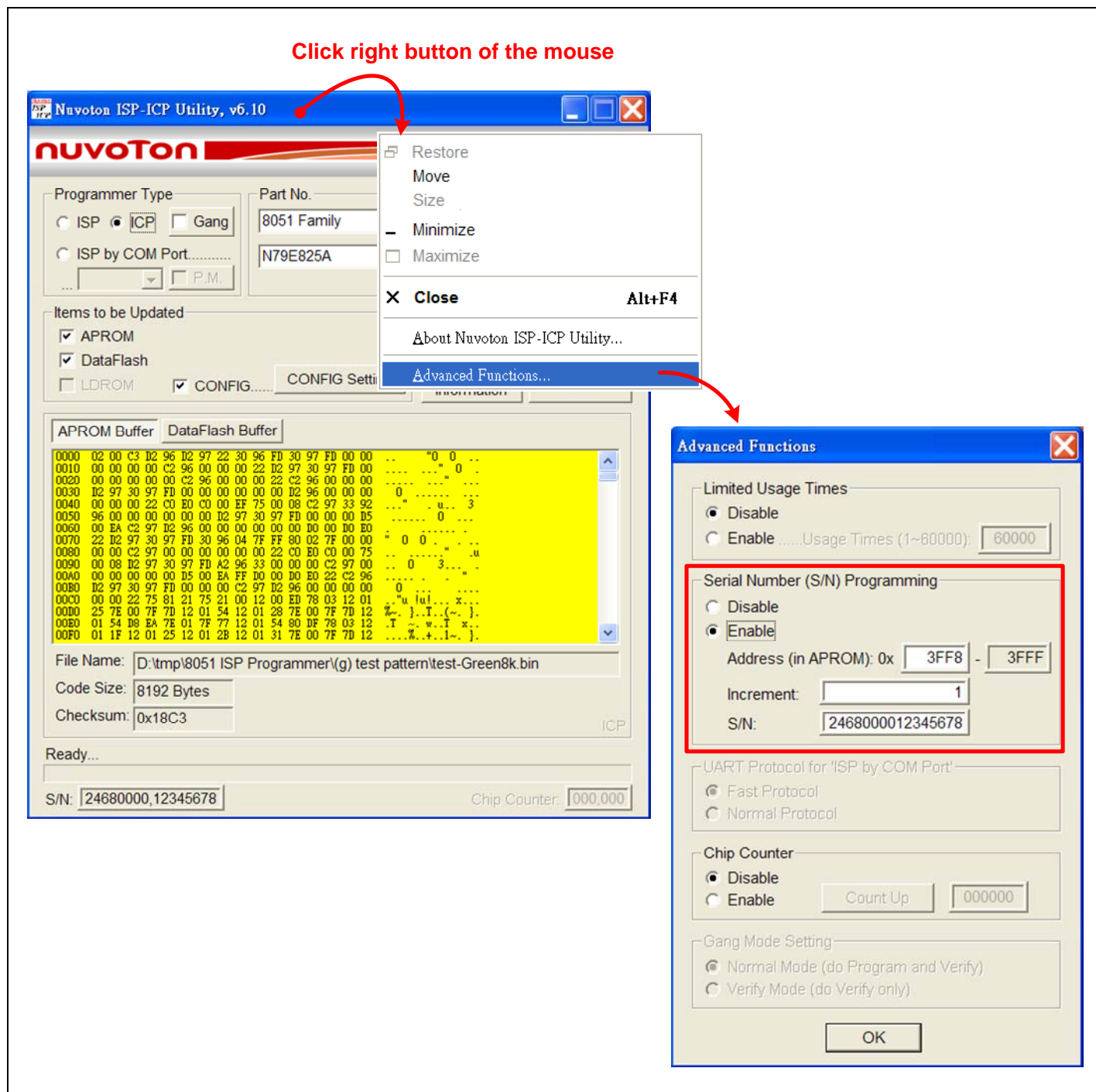
Check the Left Available Times

To check the left available times of the programmer, which was previously downloaded with *Limit Usage Times* enabled, click the 'Programmer Information' button when the programmer is connected to PC, as shown below.



7.2 Serial Number Programming

Serial number programming is supported when the programmer operates in on-line mode. 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	FF	FFFFFFFFFFFFFFFF
00003F10:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F20:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F30:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F40:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F50:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F60:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F70:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F80:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003F90:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FA0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FB0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FC0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FD0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FE0:	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FFFFFFFFFFFFFFFF
00003FF0:	FF	FF	FF	FF	FF	FF	FF	24	68	00	00	12	34	56	78	FFFFFFFF	sh..14Vx

@0x3FF8
@0x3FFF

7.3 Chip Counter

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 enable the chip counter and its various configuration.

