

# NK-980IoT Quick Start Guide

*The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.*

*Nuvoton is providing this document only for reference purposes of NUC980 microprocessor based system design. Nuvoton assumes no responsibility for errors or omissions.*

*All data and specifications are subject to change without notice.*

For additional information or questions, please contact: Nuvoton Technology Corporation.

[www.nuvoton.com](http://www.nuvoton.com)

*Table of Contents*

**1 OVERVIEW ..... 3**

**2 NUC980 LINUX BSP INTRODUCTION ..... 4**

**3 QUICK STARTING TO USE NK-980IOT ..... 5**

**4 NUWRITER TOOL ..... 11**

**4.1 SPI NAND Mode ..... 12**

    4.1.1 Operation Steps ..... 12

    4.1.2 Boot from SPI Flash ..... 16

**5 U-BOOT ..... 18**

**6 REVISION HISTORY ..... 19**

# 1 OVERVIEW

This document will provide a quick guide for Nuvoton NUC980 series chips. Users can realize what the NUC980 with Linux contains, use the NK-980IoT quickly and understand the operation process of NuWriter and U-boot.

The NK-980IoT is a development board based on an ARM® ARM926EJ-S microprocessor NUC980DK61Y which has very rich peripherals to help users easily to design-in their products or application systems.

The NK-980IoT board uses NUC980DK61Y microprocessor run up to 300 MHz with built-in 64MB DDR2 memory, 16 KB I-cache, 16 KB D-cache and MMU, 16 KB embedded SRAM and 16.5 KB IBR (Internal Boot ROM) for system booting from USB, SPI NAND flash and SD/eMMC, All functions of the NUC980DK61Y are placed on the board, including peripheral interfaces such as memory (SPI NAND flash, eMMC, SD), UART, IIS, Ethernet, USB (device, HOST), JTAG and EBI, Users can use it to develop and verify applications to emulate the real behavior.

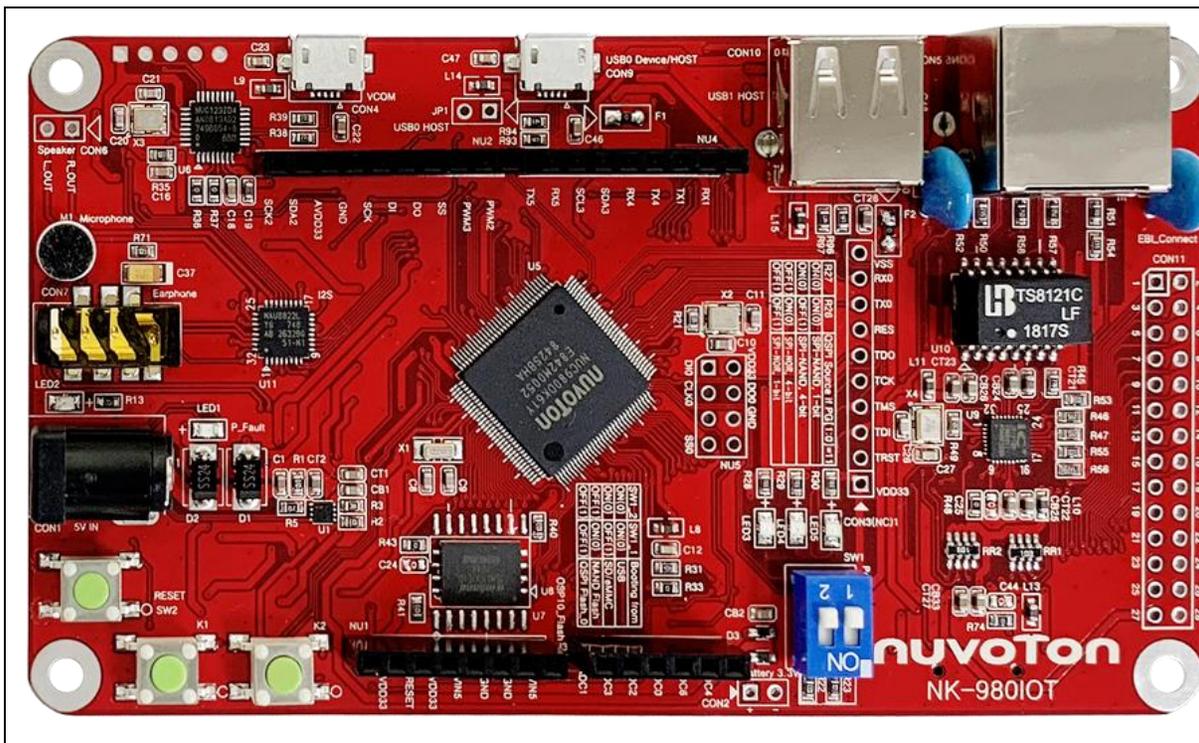


Figure 1-1 NK-980IoT Board

## 2 NUC980 LINUX BSP INTRODUCTION

This BSP supports Nuvoton NUC980 family processors. The NUC980 series targeted for general purpose 32-bit microprocessor embeds an outstanding CPU core ARM926EJ-S, a RISC processor designed by Advanced RISC Machines Ltd., runs up to 300 MHz, with 16 KB I-cache, 16 KB D-cache and MMU, 56KB embedded SRAM and 16 KB IBR (Internal Boot ROM) for booting from USB, NAND and SPI FLASH.

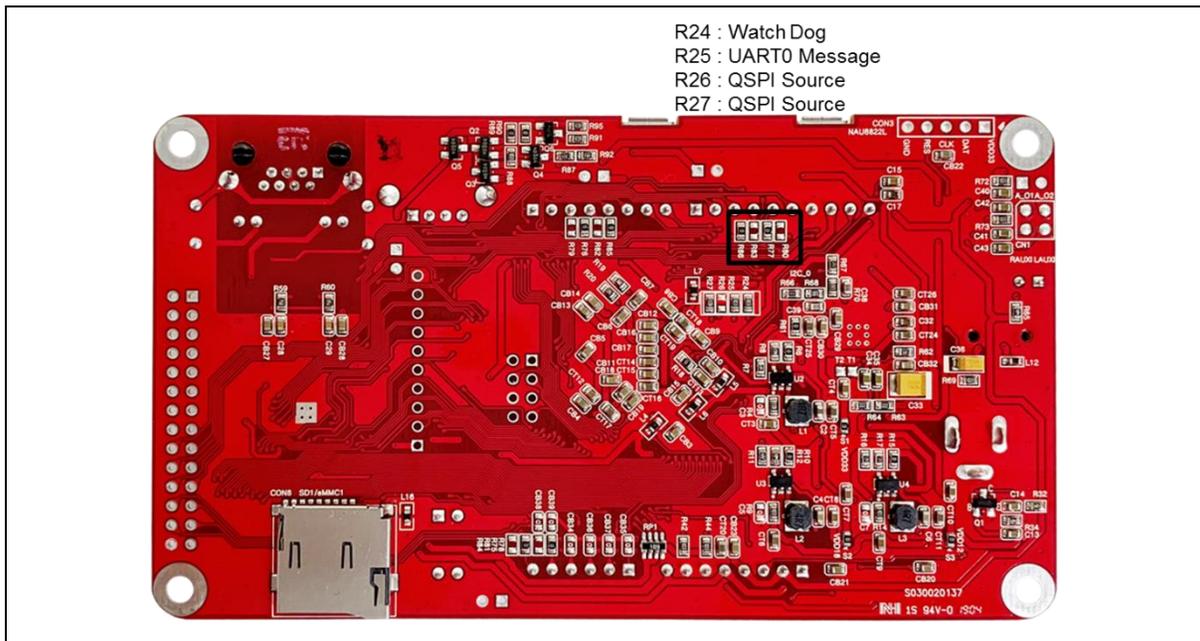
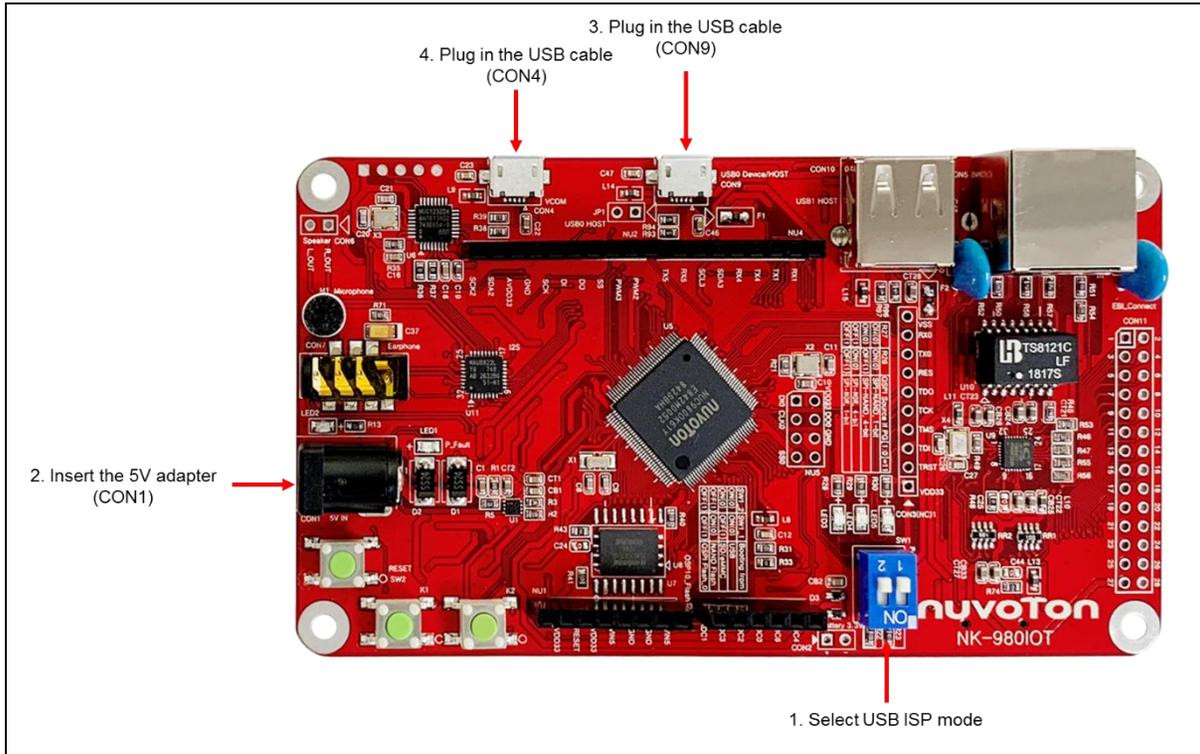
NUC980 Linux BSP provides cross compilation tools based on Linux operating system. We have tested this BSP in different x86 Linux distributions, including Ubuntu, CentOS, and Debian...etc. Because there are so many distributions out there with different system configuration, sometimes it is necessary to change system setting or manually install some missing component in order to cross compile.

Linux development environment could either be native, or install in a virtual machine execute on top of other operating system.

For more detailed on how to download and install VMware virtual machine, please refer to “**NUC980 Linux 3.10 BSP User Manual EN**” in the “Documents” directory.

### 3 QUICK STARTING TO USE NK-980IOT

This chapter will help users easily to use NK-980IoT step by step.



**1. Select USB ISP mode and enable the UART\_0 message**

NK-980IoT provides jumpers (SW1) to select boot-up conditions. The jumpers (SW1) ON to select USB ISP mode

Switch	Status	Function	GPIO pin of NUC980
SW1.2/SW1.1	ON/ON	Boot from USB	GPG1/GPG0
SW1.2/SW1.1	ON/OFF	Boot from SD/eMMC	GPG1/GPG0
SW1.2/SW1.1	OFF/ ON	Boot from NAND Flash	GPG1/GPG0
SW1.2/SW1.1	OFF/OFF	Boot from QSPI0 Flash	GPG1/GPG0

NK-980IoT development board defaults to enable the UART\_0 message.If you need to disable the NK-980IoT development board UART\_0 message, you must remove the resistor R25.

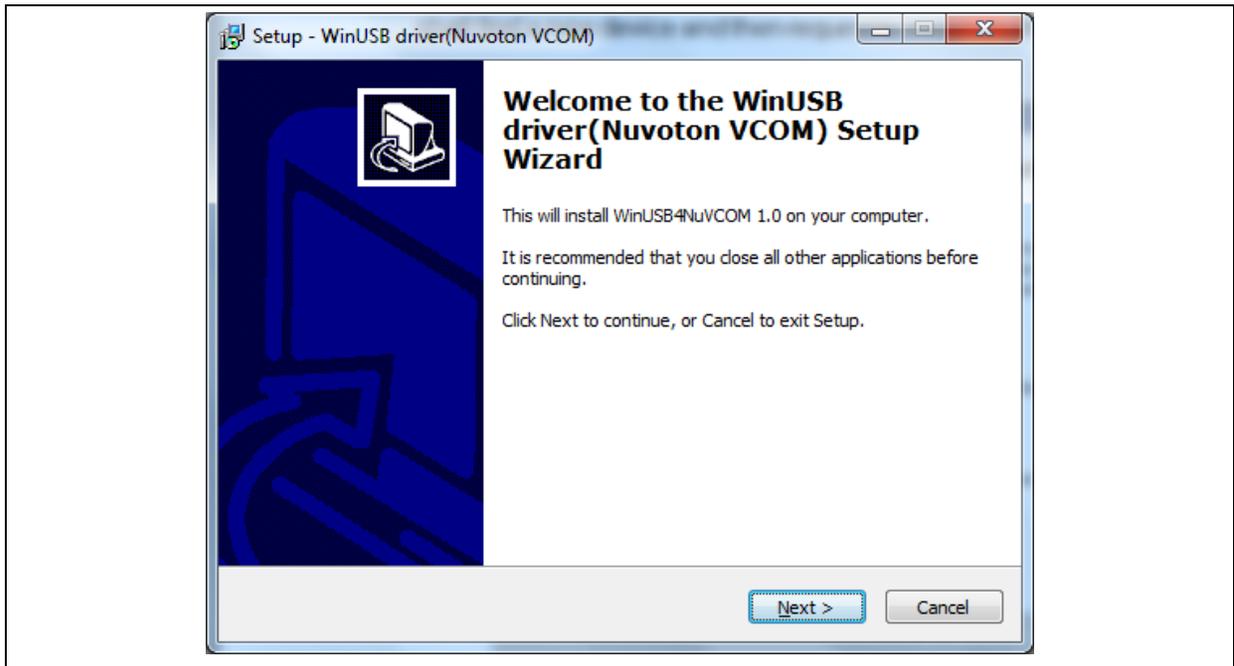
Switch	Status	Function	GPIO pin of NUC980
R24	ON/OFF	Watch Dog	GPG3
R25	ON/OFF	UART0 Message	GPG5
R27/R26	ON/ON	SPI NAND, 1 bit	GPG9/GPG8
R27/R26	ON/OFF	SPI NAND, 4 bit	GPG9/GPG8
R27/R26	OFF/ ON	SPI NOR, 4 bit	GPG9/GPG8
R27/R26	OFF/OFF	SPI NOR, 1 bit	GPG9/GPG8

**2. Insert the 5V adapter (CON1)**

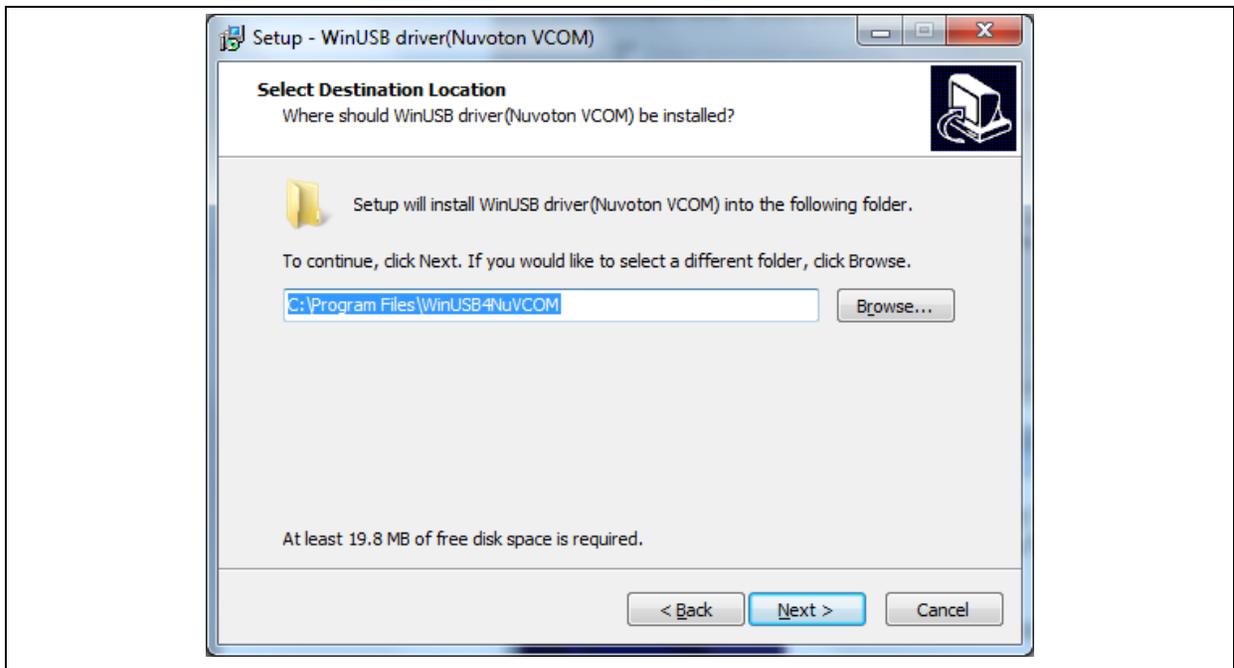
**3. Plug in the USB cable (CON9)**

The burning tool requires a NuWriter driver to be installed on PC first. Please follow the steps below to install the driver.

Run the “WinUSB4NuVCOM.exe” before the USB cable is plugged in. The “WinUSB4NuVCOM.exe” can be found in the “Tool” directory. Power on the NUC980 Series MPU EVB and plug the USB cable into PC, the Windows shall find a new device and then request to install its driver.

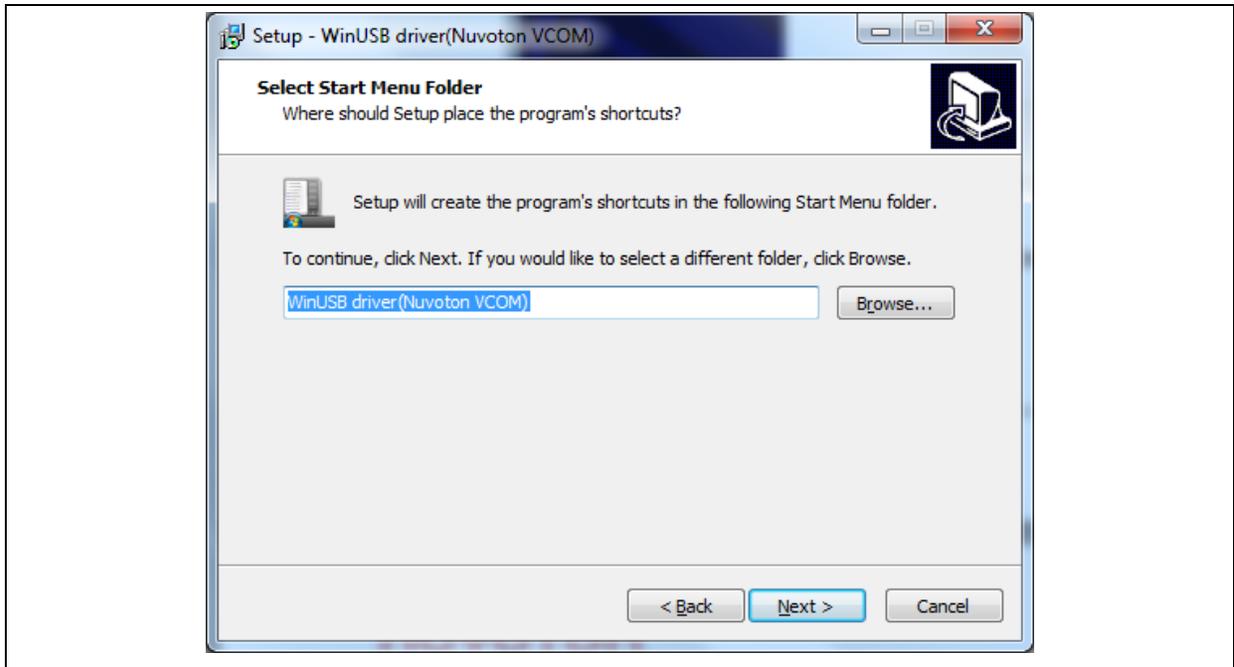


Click **Next**. The software installation will ask you how to install the driver.

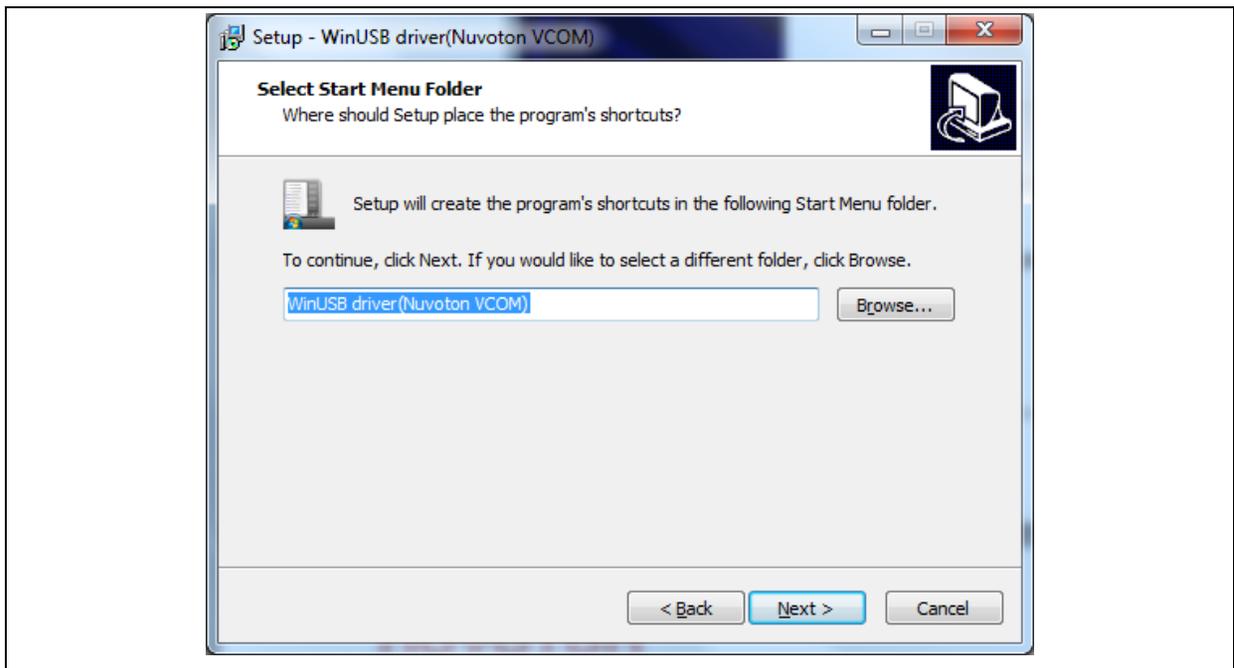


Select "setup path" to specific location (Advanced), and then click **Next**. The installation software will ask you the option.

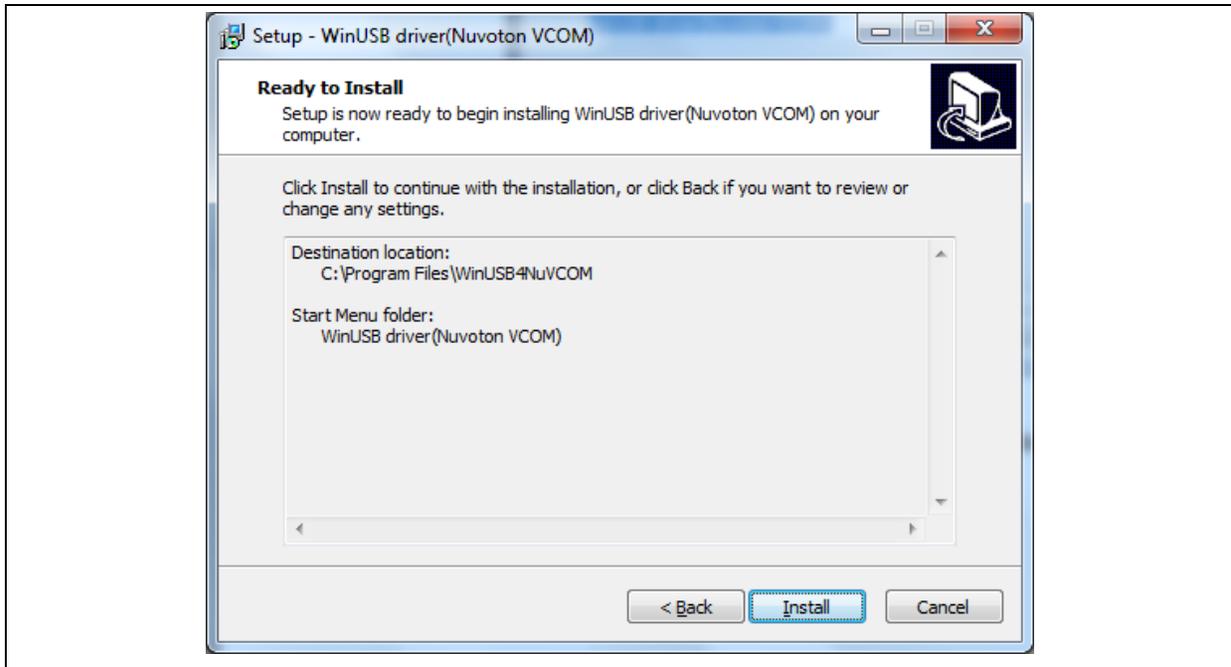
Click "Next". As follows.



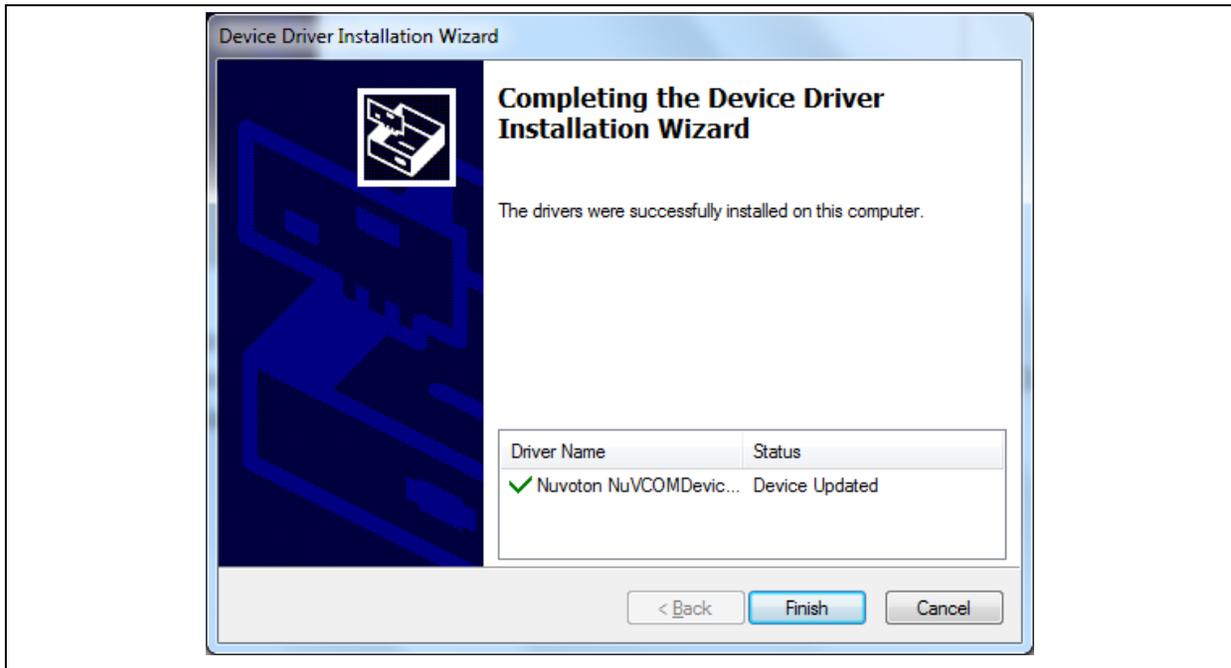
Click "Next". As follows.



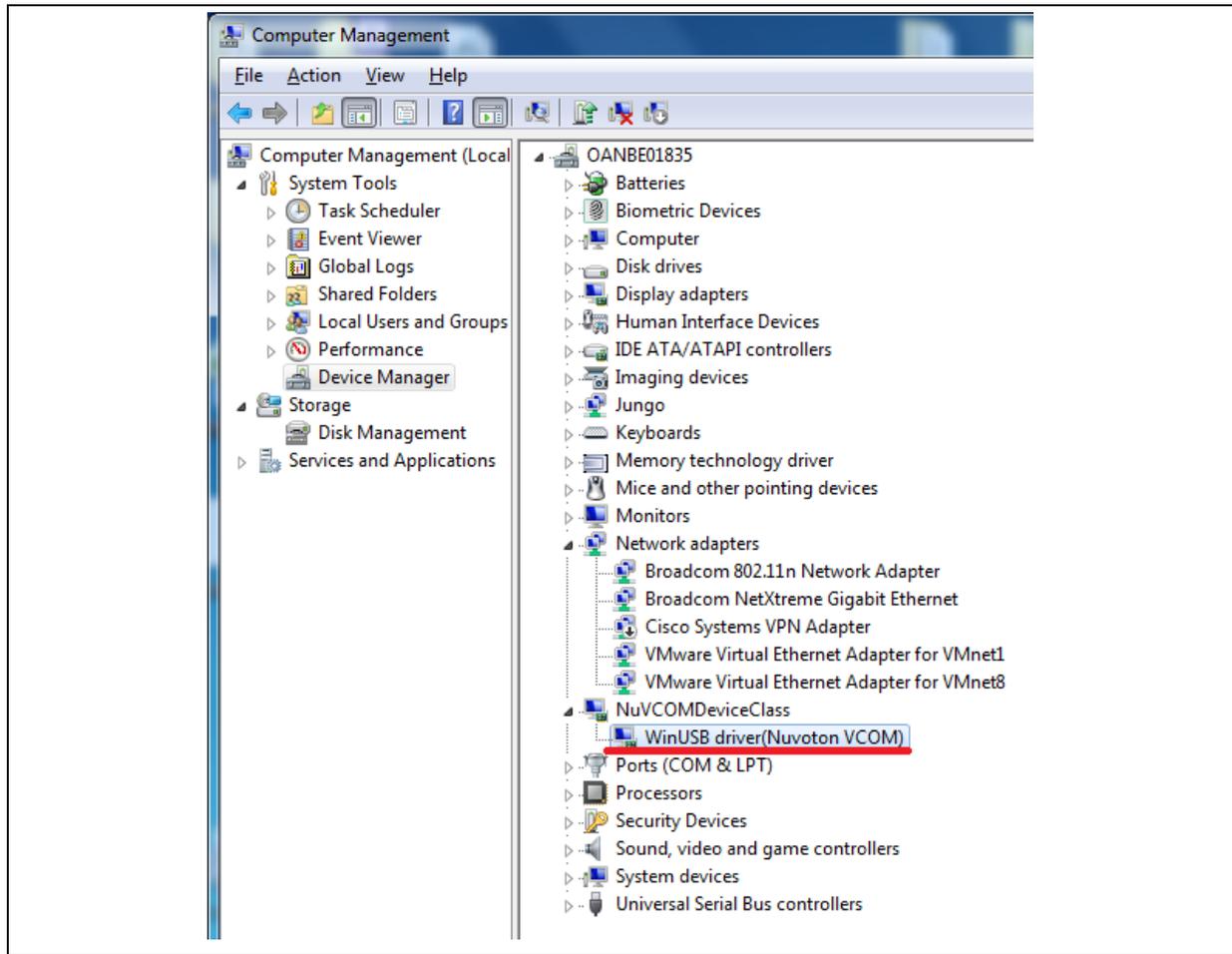
Click **“Install”**. As follows.



Click **“Finish”** to finish install driver. As follows.



If the installation is successful, a virtual COM port named **“WinUSB driver (Nuvoton VCOM)”** can be found by using **“Device Manager”** to check the ports devices.



**4. Plug in the USB cable (CON4)**

The PC will recognize the board as a USB composite device.

The USB serial port function is used to print some messages on PC API, such as SecureCRT, through the standard UART protocol to help user to debug program.

For detailed NK-980IoT board introduction, please refer to “**NK-980IoT User Manual**” in the “Documents” directory.

#### 4 NUWRITER TOOL

NuWriter can download images to NAND flash while NUC980 is in USB ISP mode. This chapter will guide users to use this tool boot-up from SPI NAND flash

The NUC980 Series MPU EVB provides jumpers to select boot-up conditions. To select USB ISP mode, the statuses of SW1.1 and SW1.2 are ON. Other boot selects can refer to the following table:

Power-on setting	SW1.2	SW1.1
USB ISP	ON	ON
Boot from eMMC/SD	ON	OFF
Boot from NAND	OFF	ON
Boot from SPI	OFF	OFF

Power-on NUC980 Series MPU EVB, and then open the burning tool, “NuWriter.exe”, on the PC. Note that the tool cannot work if the “WinUSB4NuVCOM” driver is not found.

First, double click “NuWriter.exe” on PC. NuWriter will start and a window appears. Select target chip to NUC980 series and select DDR parameter to DDR initial files.

After select DDR parameter, click “Continue” to use NuWriter tool.

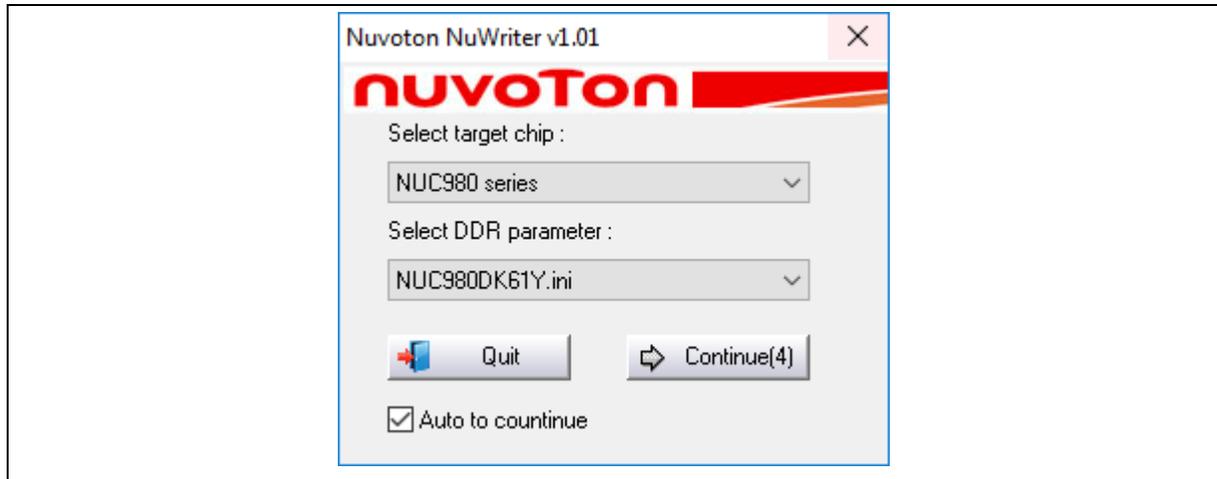


Figure 4-1 NuWriter – Set Chip

NuWriter provides 7 types to be downloaded images including DDR/SRAM, SPI, NAND, eMMC/SD, SPI NAND, PACK and Mass Production. This chapter will guide users to download images to SPI NAND flash. If users want to choose others types to download images. Please refer to “**NUC980 NuWriter User Manual**” in the “Documents” directory.

### 4.1 SPI NAND Mode

This mode can write a new image to SPI NAND flash and specify the type of the image. These types can be recognized by uboot or Linux. The Image type is set Loader, Data, Environment or Pack.

#### 4.1.1 Operation Steps

According to the figure below, follow the below steps to add image to SPI NAND flash:

1. Select the “**SPI NAND**” type, which will not list the pre-burned images in the SPI NAND Flash ROM.
2. Fill in the image information :
  - Image Name : Browse the image file
  - Image Type Select the image type (only one type can be selected)
  - Image execute address: Enter image execute address. Only is Loader Type is valid.
  - Image start offset: Enter image start offset.
3. Click “Program”.
4. Waiting for finishing progress bar.
5. After “Program” the image, click the “**Verify**” button to read back the image data to make sure the burning status.

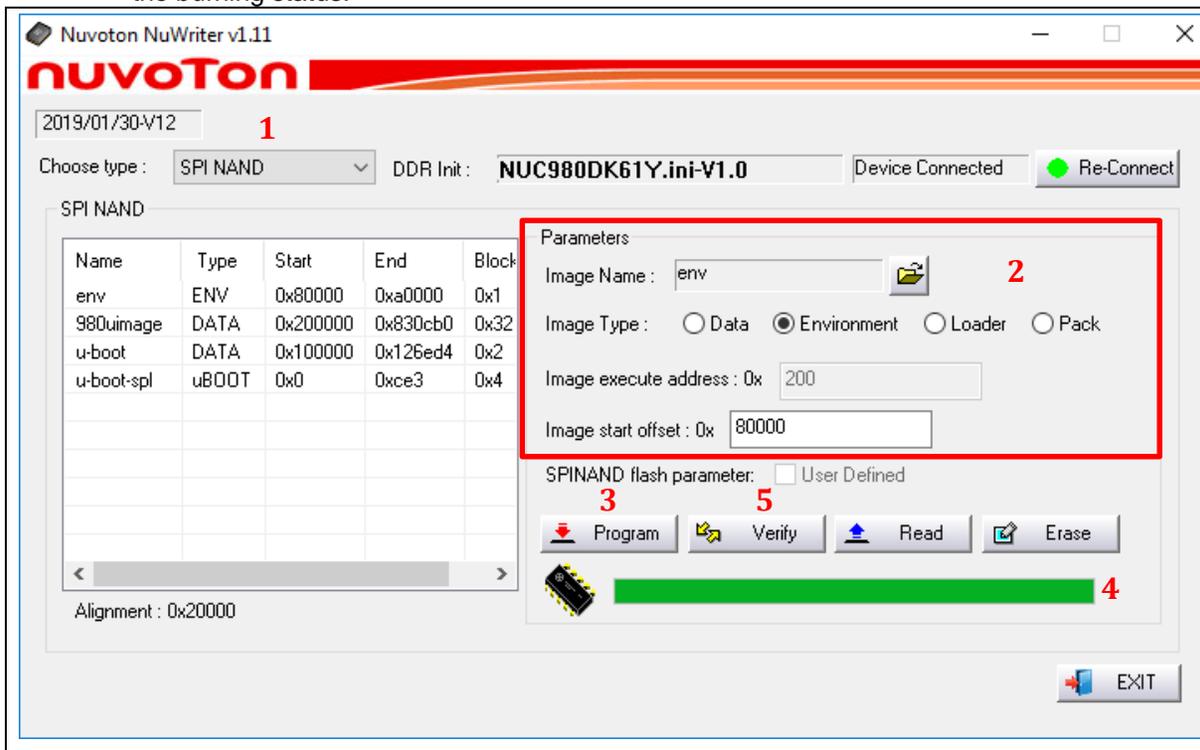


Figure 4-2 SPI NAND – New Image



4.1.1.2 SPI NAND – u-boot

For the Linux system, Loader Type is used to boot the Linux kernel. To compile NUC980 U-Boot to get Main U-Boot and SPL U-Boot. The Main U-Boot is a fully featured version of U-Boot. In this case, The Main U-Boot need to set the address at 0x100000 address.

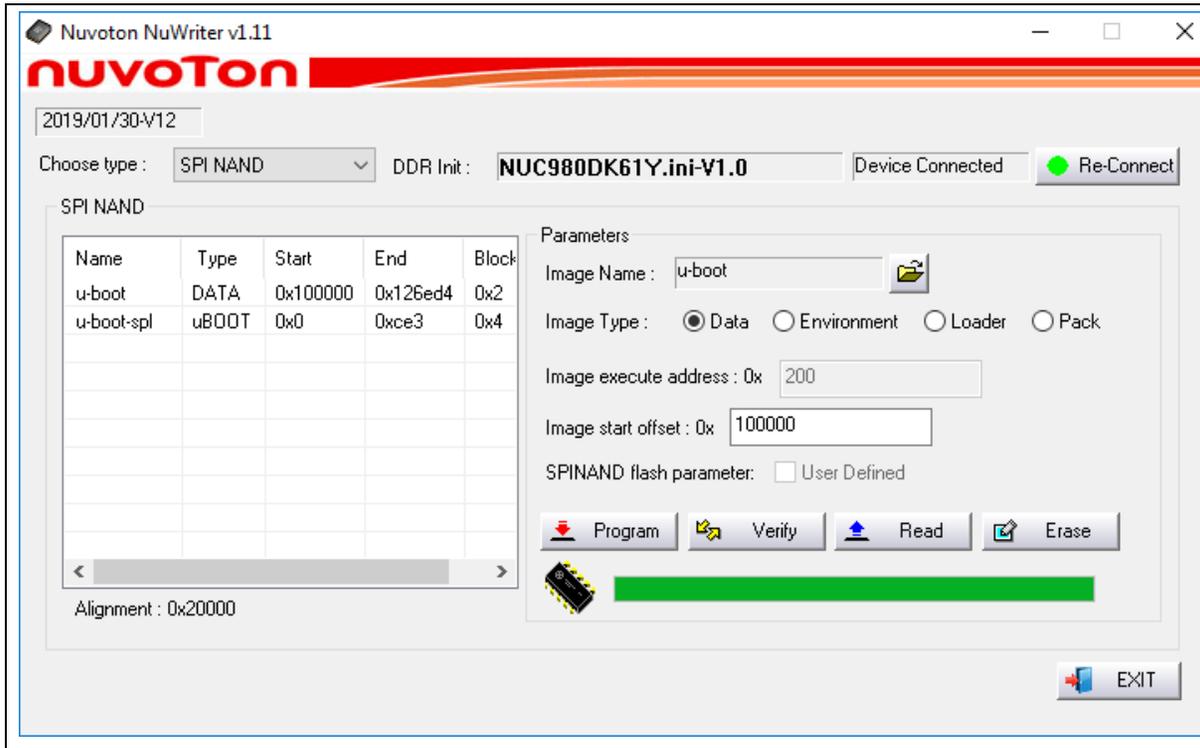


Figure 4-4 SPI NAND – u-boot

4.1.1.3 SPI NAND – 980uimage

Mainly the image of data type into SPI NAND flash in the specified address. Depending on the value of image start offset (aligned on block size boundary, block size is based on SPI NAND specifications). If image start offset equal then 0x200000, image of data into SPI NAND flash in the 0x200000 address, it can help user to configure SPI NAND flash.

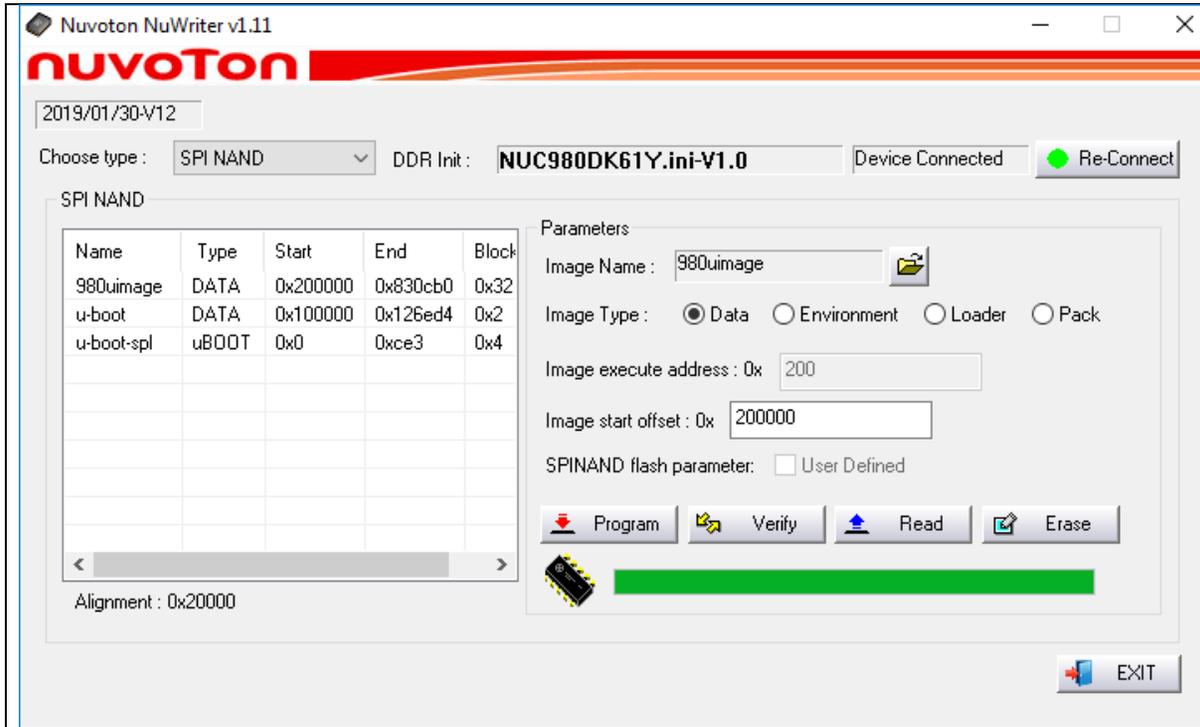


Figure 4-5 SPI NAND – 980uimage

4.1.1.4 SPI NAND – environment

Loader Type is set uboot environment variables, the image of environment type into SPI NAND flash in the specified address. U-Boot reads environment variables file to set the environment. If image start offset equal then 0x80000, image of data into SPI NAND flash in the 0x80000 address, it can help user to configure SPI NAND flash.

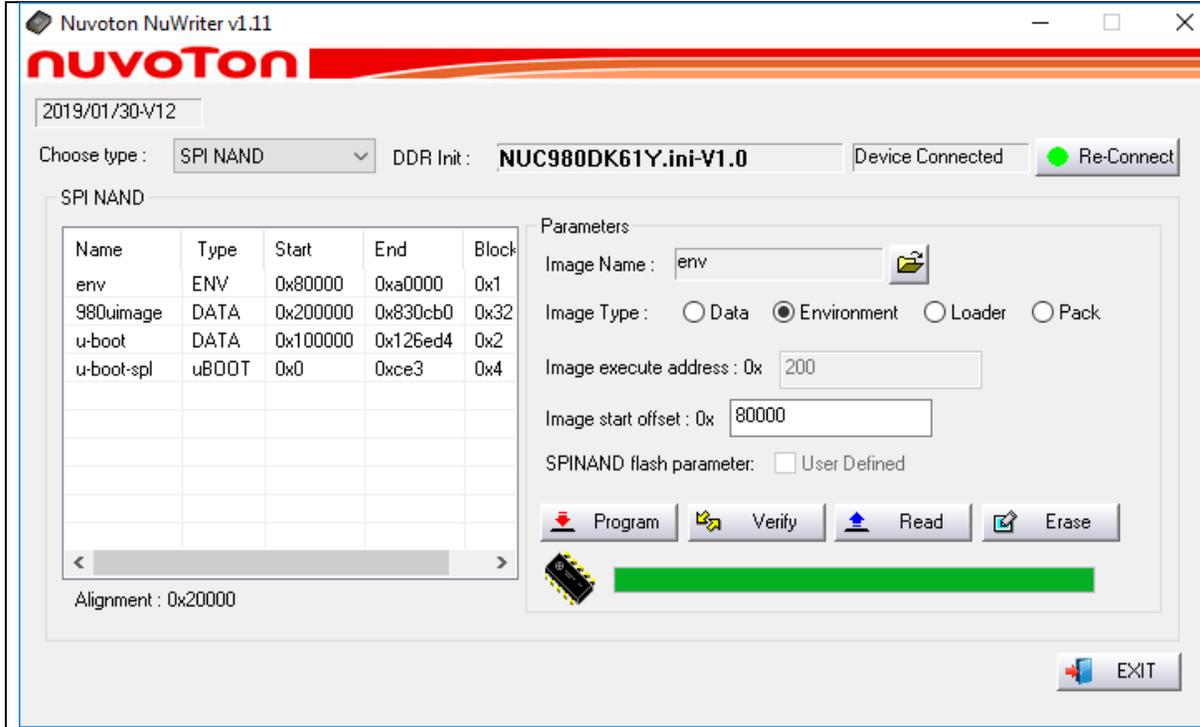


Figure 4-6 SPI NAND – environment

4.1.2 Boot from SPI Flash

The NUC980 Series MPU EVB provides jumpers to select boot-up conditions. According to the following switches, users can boot from SPI Flash and watch the successful boot message from UART\_0.

SW	Description (Status and Function)	GPIO pin of NUC980
SW1.2/ SW1.1	<b>Boot Source Selection</b> OFF/OFF = Boot from SPI Flash.	GPG1/GPG0
R24	<b>Watchdog Timer (WDT) Enabled/Disabled Selection</b> ON = After power-on, WDT Disabled. OFF = after power-on WDT Enabled	GPG3
R25	<b>UART 0 Debug Message Output ON/OFF Selection</b> ON = UART 0 debug message output ON.	GPG5
R27, R26	<b>SPI Flash type and data width selection</b> ON/ON = SPI-NAND Flash with 1-bit mode. ON/OFF = SPI-NAND Flash with 4-bit mode. OFF/ON = SPI-NOR Flash with 4-bit mode. OFF/OFF = SPI-NOR Flash with 1-bit mode.	GPG9/ GPG8

```

NUC980 IBR 20180813
Boot from SPI-NAND
DDR-OK                               Boot
finish SPI download

SPL load main U-Boot from SPI NAND Flash! (Feb 20 2019 09:12:29)

U-Boot 2016.11-g8127c47 (Feb 20 2019 - 09:12:26 +0800)

CPU: NUC980
Board: NUC980
DRAM: 64 MiB
SF: Detected W25N01GV with page size 2 KiB, erase size 128 KiB, total 128 MiB
In: serial
Out: serial
Err: serial
Net: Net Initialization Skipped
No ethernet found.
Hit any key to stop autoboot: 0
SF: Detected W25N01GV with page size 2 KiB, erase size 128 KiB, total 128 MiB
device 0 offset 0x200000, size 0x800000
SF: 8388608 bytes @ 0x200000 Read: OK
## Booting kernel from Legacy Image at 00007fc0 ...
Image Name: Linux-4.4.115+
Image Type: ARM Linux Kernel Image (uncompressed)
Data Size: 6491128 Bytes = 6.2 MiB
Load Address: 00008000
Entry Point: 00008000
Verifying Checksum ... OK
XIP Kernel Image ... OK
    
```

Figure 4-7 Application –LED as an example, Message - Boot from SPI Flash

For more detailed NuWriter tool, please refer to “**NUC980 NuWriter User Manual**” in the “Documents” directory.

## 5 U-BOOT

The U-Boot utility is a multi-platform, open-source, universal boot-loader with comprehensive support for loading and managing boot images, such as the Linux kernel. It supports the following features:

- Network download: TFTP, BOOTP, DHCP
- Serial download: s-record, binary (via Kermit)
- Flash management: erase, read, update, yaffs2
- Flash types: SPI flash, NAND flash
- Memory utilities: dump, compare, copy, write
- Interactive shell: commands with scripting features

NUC980 U-Boot version is v2016.11. It is downloaded from <http://www.denx.de/wiki/U-Boot/SourceCode>

For detailed NK-980IoT board introduction, please refer to “**NUC980 U-Boot v2016\_11 User Manual**” in the “Documents” directory.

## 6 REVISION HISTORY

Date	Revision	Description
2019.02.25	1.00	Initial release
2019.03.18	1.01	Add operation steps for booting from SPI NAND

### Important Notice

**Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, “Insecure Usage”.**

**Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.**

**All Insecure Usage shall be made at customer’s risk, and in the event that third parties lay claims to Nuvoton as a result of customer’s Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.**

---

*Please note that all data and specifications are subject to change without notice.  
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.*