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**1T 8051****8-bit Microcontroller**

# **NuMaker-MS51PC**

## **User Manual**

### **NuMicro<sup>®</sup> 8051 Series**

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## 1 OVERVIEW

This user manual is aimed to give users a fast introduction to the use of NuMaker-MS51PC board.

The NuMaker-MS51PC consists of two parts, a MS51 platform and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-MS51PC allows users to quickly develop and easily program and debug application.

The NuMaker-MS51PC offers MS51PC0AE full pins extension connectors, Arduino UNO compatible extension connectors and diversified power supply option. It is an easy-to-develop platform for user to expand the functionality and build the applications. The NuMaker-MS51PC also provides an ammeter connector, allows user to monitor the microcontroller's power consumption during development.

The Nu-Link2-Me is a debugger and programmer that support on-line programming and debugging through OCD interface. The on-board 16 Mbit SPI Flash allows it able to off-line programming the target microcontroller. Nu-Link2-Me provides virtual COM port (VCOM) function to print out messages on PC. Nu-Link2-Me can be separated from NuMaker-MS51PC, allowing user to use as a mass production programming tool.

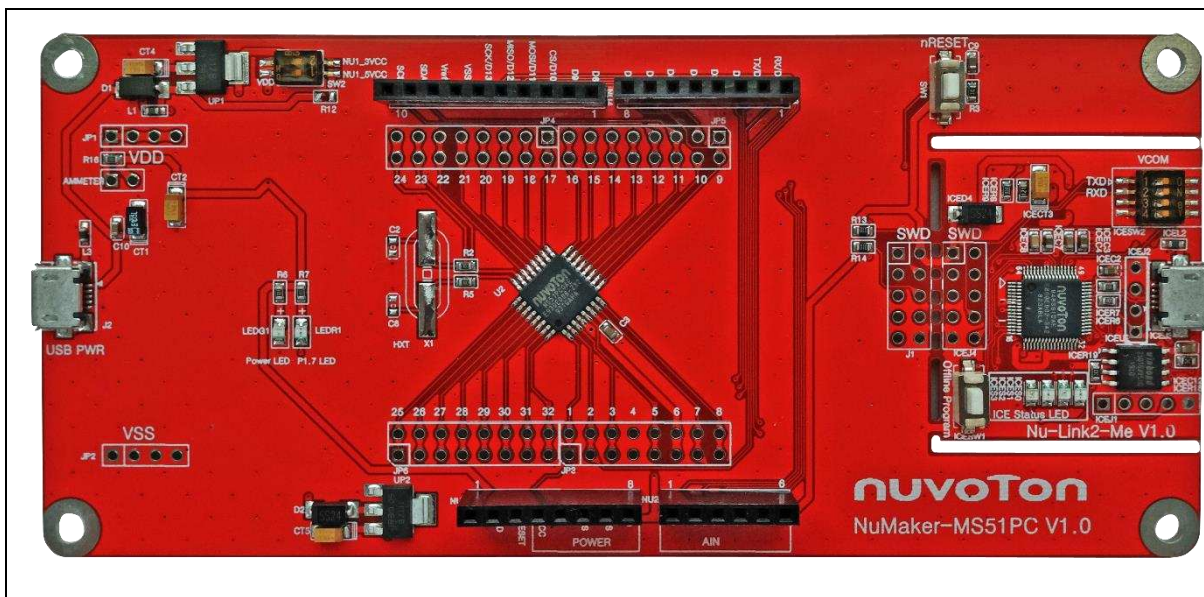


Figure 1.1-1 NuMaker-MS51PC Board

## 1.1 NuMaker-MS51PC Features

- NuMicro® MS51PC0AE used as main microcontroller with function downward compatible with:
  - ◆ MS51EC0AE
  - ◆ MS51FC0AE
  - ◆ MS51TC0AE
  - ◆ ML51XC0AE
- MS51PC0AE full pins extension connectors
- Arduino UNO compatible extension connectors
- Ammeter connector for measuring the microcontroller's power consumption
- Fixable board power supply:
  - ◆ External  $V_{DD}$  power connector
  - ◆ Arduino UNO compatible extension connector  $V_{in}$
  - ◆ USB power connector on MS51 platform
  - ◆ ICE USB connector on Nu-Link2-Me
- On-board Nu-Link2-Me debugger and programmer:
  - ◆ Debug through OCD interface
  - ◆ On-line/off-line programming
  - ◆ Virtual COM port function



## 2 NUMAKER-MS51PC OVERVIEW

### 2.1 Front View

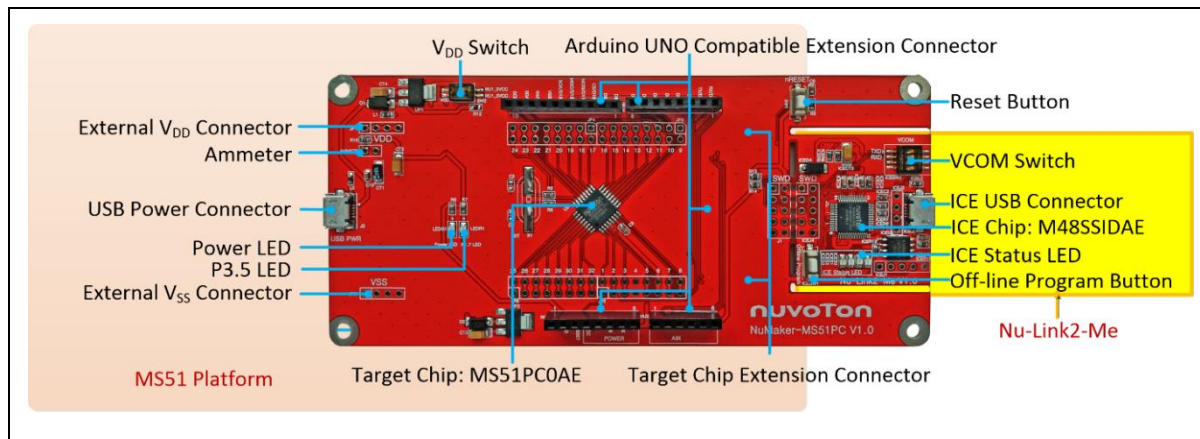


Figure 2.1-1 Front View of NuMaker-MS51PC

Figure 2.1-1 shows the main components and connectors from the front side of NuMaker-MS51PC. The following lists components and connectors from the front view:

- Target Chip: MS51PC0AE (U2)
- USB Power Connector (J2)
- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)
- MS51 Extension Connectors (JP3, JP4, JP5 and JP6)
- External  $V_{DD}$  Power Connector(JP1)
- External  $V_{SS}$  Power Connector(JP2)
- $V_{DD}$  Switch(SW2)
- Ammeter Connector(AMMETER)
- Reset Button(SW1)
- Power LED and P3.5 LED (LEDG1 and LEDR1)
- Nu-Link2-Me
  - ◆ VCOM Switch
  - ◆ ICE Chip: M48SSIDAE(ICEU2)
  - ◆ ICE USB Connector(ICEJ3)
  - ◆ ICE Status LED (ICES0,ICES1, ICES2, ICES3)
  - ◆ Off-line Program Button(ICESW1)

## 2.2 Rear View

Figure 2.2-1 shows the main components and connectors from the rear side of NuMaker-MS51PC.

The following lists components and connectors from the rear view:

- Nu-Link2-Me
  - ◆ MCUVCC Power Switch (ICEJPR1)
  - ◆ ICEVCC Power Switch (ICEJPR2)

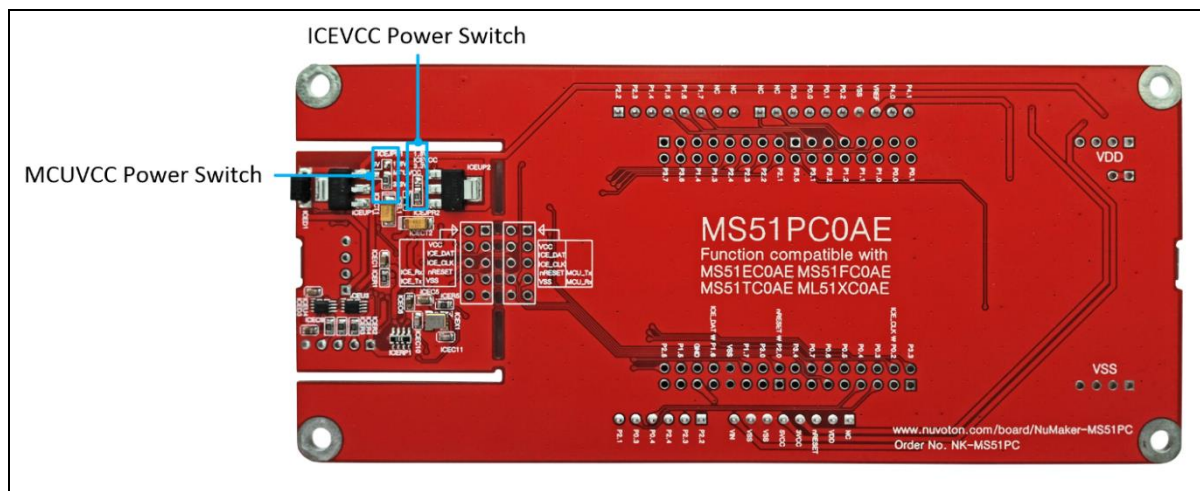


Figure 2.2-1 Rear View of NuMaker-MS51PC

2.3 Arduino UNO Compatible Extension Connectors

Figure 2.3-1 shows the Arduino UNO compatible extension connectors.

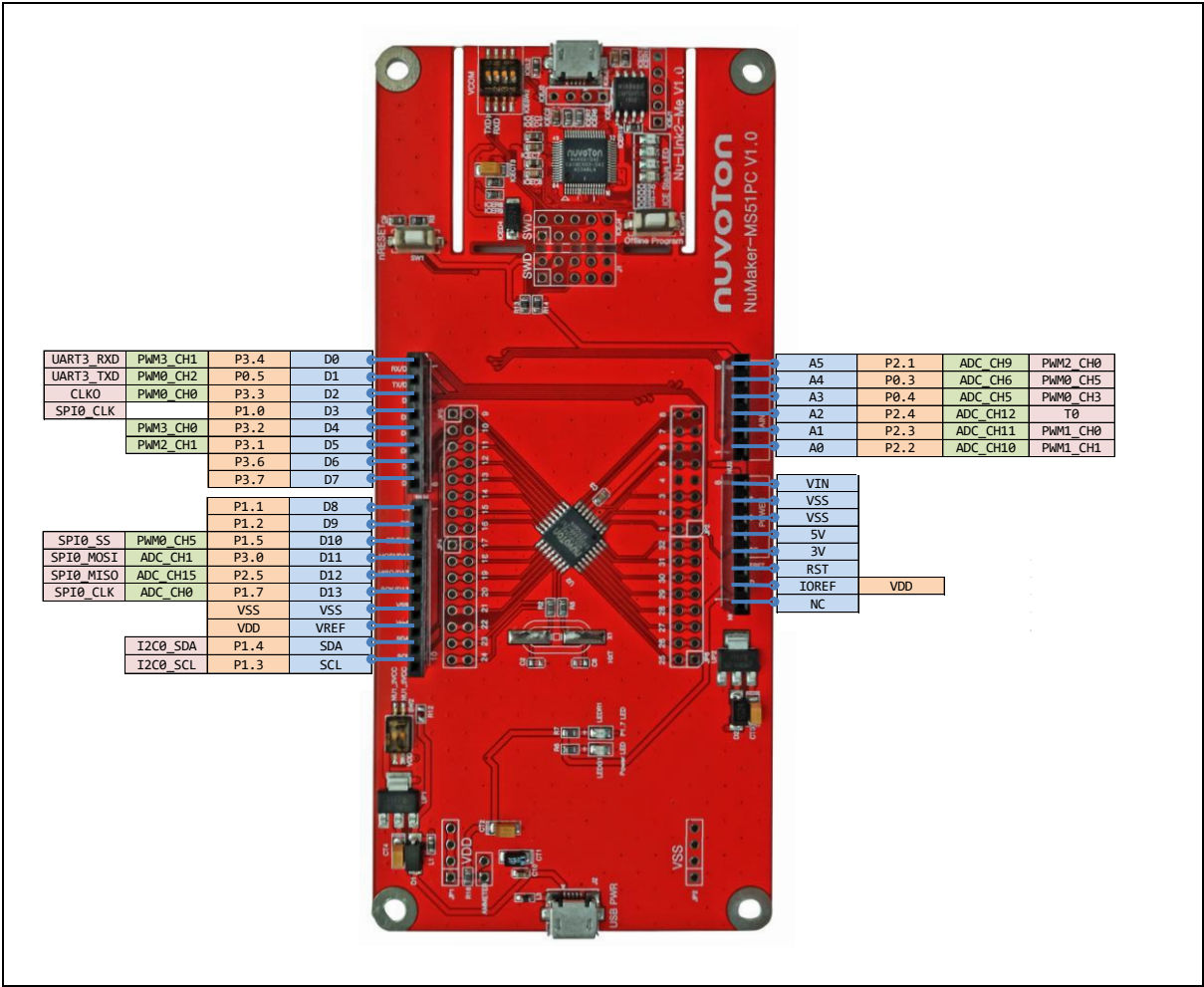


Figure 2.3-1 Arduino UNO Compatible Extension Connectors

| Header               |        | NuMaker-MS51PC               |                  | Header               |       | NuMaker-MS51PC               |                  |
|----------------------|--------|------------------------------|------------------|----------------------|-------|------------------------------|------------------|
|                      |        | Compatible to<br>Arduino UNO | GPIO Pin of MS51 |                      |       | Compatible to<br>Arduino UNO | GPIO Pin of MS51 |
| <b>N<br/>U<br/>3</b> | NU3.1  | D0                           | P3.4             | <b>N<br/>U<br/>2</b> | NU2.6 | A5                           | P2.1             |
|                      | NU3.2  | D1                           | P0.5             |                      | NU2.5 | A4                           | P0.3             |
|                      | NU3.3  | D2                           | P3.3             |                      | NU2.4 | A3                           | P0.4             |
|                      | NU3.4  | D3                           | P1.0             |                      | NU2.3 | A2                           | P2.4             |
|                      | NU3.5  | D4                           | P3.2             |                      | NU2.2 | A1                           | P2.3             |
|                      | NU3.6  | D5                           | P3.1             |                      | NU2.1 | A0                           | P2.2             |
|                      | NU3.7  | D6                           | P3.6             | <b>N<br/>U<br/>1</b> | NU1.8 | VIN                          | -                |
|                      | NU3.8  | D7                           | P3.7             |                      | NU1.7 | VSS                          |                  |
| <b>N<br/>U<br/>4</b> | NU4.1  | D8                           | P1.1             |                      | NU1.6 | VSS                          |                  |
|                      | NU4.2  | D9                           | P1.2             |                      | NU1.5 | 5V                           |                  |
|                      | NU4.3  | D10                          | P1.5             |                      | NU1.4 | 3V                           |                  |
|                      | NU4.4  | D11                          | P3.0             |                      | NU1.3 | RST                          | nRESET           |
|                      | NU4.5  | D12                          | P2.5             |                      | NU1.2 | IOREF                        | VDD              |
|                      | NU4.6  | D13                          | P1.7             |                      | NU1.1 | NC                           | -                |
|                      | NU4.7  | VSS                          | VSS              |                      |       |                              |                  |
|                      | NU4.8  | VREF                         | VDD              |                      |       |                              |                  |
|                      | NU4.9  | I2C_SDA                      | P1.4             |                      |       |                              |                  |
|                      | NU4.10 | I2C_SCL                      | P1.3             |                      |       |                              |                  |

Table 2.3-1 Arduino UNO Extension Connectors and MS51PC0AE Mapping GPIO List

## 2.4 Pin Assignment for Extension Connectors

The NuMaker-MS51PC provides the MS51PC0AE target chip onboard and full pins extension connectors (JP3, JP4, JP5 and JP6). The Figure 2.4-1 shows the MS51PC0AE extension connectors.

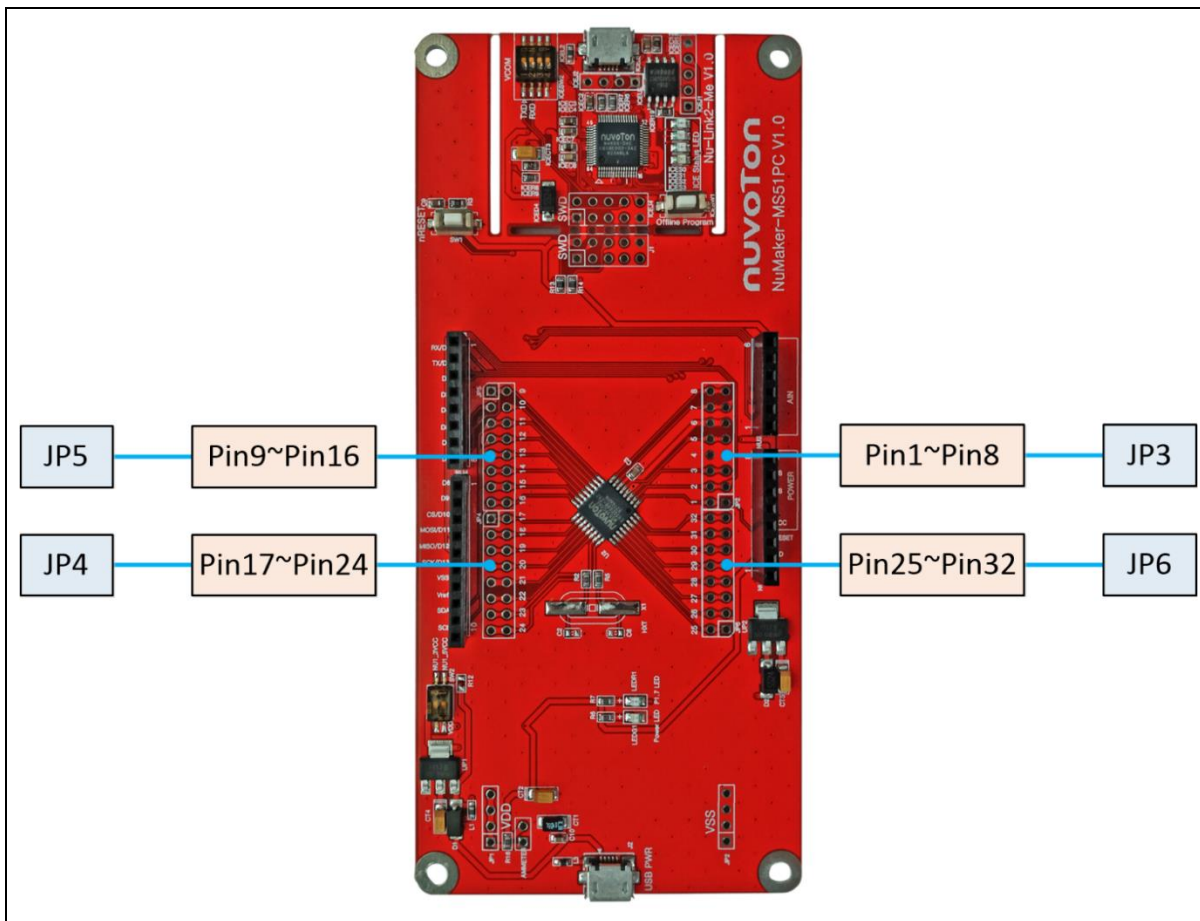


Figure 2.4-1 MS51PC0AE Extension Connectors

| Header |        |        | MS51PC0AE |                                                         |
|--------|--------|--------|-----------|---------------------------------------------------------|
|        |        |        | Pin No.   | Function                                                |
| JP3    | JP3.1  | JP3.2  | 1         | P2.0/RESET                                              |
|        | JP3.3  | JP3.4  | 2         | P3.0/OSCIN/INT0/UART2_TX/SPI0_MOSI/ADC_CH1              |
|        | JP3.5  | JP3.6  | 3         | P1.7/INT1/UART2_RX/SPI0_CLK/ADC_CH0                     |
|        | JP3.7  | JP3.8  | 4         | VSS                                                     |
|        | JP3.9  | JP3.10 | 5         | P1.6/ICE_DAT/ICP_DAT/UART1_TX/I2C0_SDA                  |
|        | JP3.11 | JP3.12 | 6         | GND                                                     |
|        | JP3.13 | JP3.14 | 7         | P1.5/UART3_TX/SPI0_SS/IC7/PWM3_CH1/PWM0_CH5             |
|        | JP3.15 | JP3.16 | 8         | P2.5/UART3_RX/SPI0_MISO/ADC_CH15                        |
| JP5    | JP5.1  | JP5.2  | 9         | P3.7/UART1_RX                                           |
|        | JP5.3  | JP5.4  | 10        | P3.6/UART1_TX                                           |
|        | JP5.5  | JP5.6  | 11        | P1.4/PWM0_CH1/I2C0_SDA/PWM0_BRAKE/ADC_CH14/PWM1_CH1     |
|        | JP5.7  | JP5.8  | 12        | P1.3/STADC/I2C0_SCL/ADC_CH13                            |
|        | JP5.9  | JP5.10 | 13        | P2.4/T0/ADC_CH12                                        |
|        | JP5.11 | JP5.12 | 14        | P2.3/UART4_TX/PWM1_CH0/ADC_CH11                         |
|        | JP5.13 | JP5.14 | 15        | P2.2/UART4_RX/PWM1_CH1/ADC_CH10                         |
|        | JP5.15 | JP5.16 | 16        | P2.1/PWM2_CH0/ADC_CH9                                   |
| JP4    | JP4.1  | JP4.2  | 17        | P3.5/SPI0_SS                                            |
|        | JP4.3  | JP4.4  | 18        | P3.1/PWM2_CH1                                           |
|        | JP4.5  | JP4.6  | 19        | P3.2/PWM3_CH0                                           |
|        | JP4.7  | JP4.8  | 20        | P1.2/PWM0_CH0/IC0/UART3_TXD/PWM1_CH0                    |
|        | JP4.9  | JP4.10 | 21        | P1.1/ADC_CH7/CLKO/IC1/PWM0_CH1/UART3_RXD/PWM1_CH1       |
|        | JP4.11 | JP4.12 | 22        | P1.0/PWM0_CH2/SPI0_CLK/IC2/UART1_TXD/PWM2_CH0           |
|        | JP4.13 | JP4.14 | 23        | P0.0/PWM0_CH3/SPI0_MOSI/IC3/UART1_RXD/T1/HXTIN/PWM2_CH1 |
|        | JP4.15 | JP4.16 | 24        | P0.1/PWM0_CH4/SPI0_MISO/IC4/HXTOUT/PWM3_CH0             |
| JP6    | JP6.1  | JP6.2  | 25        | P3.3/ICE_CLK/I2C0_SCL/UART1_RXD                         |
|        | JP6.3  | JP6.4  | 26        | P0.2/ICE_CLK/I2C0_SCL/UART1_RXD                         |
|        | JP6.5  | JP6.6  | 27        | P0.3/ADC_CH6/IC5/PWM0_CH5/UART2_TXD/PWM3_CH1            |
|        | JP6.7  | JP6.8  | 28        | P0.4/ADC_CH5/IC3/PWM0_CH3/STADC/UART2_RXD/PWM2_CH1      |
|        | JP6.9  | JP6.10 | 29        | P0.5/ADC_CH4/PWM0_CH2/PWM2                              |
|        | JP6.11 | JP6.12 | 30        | P0.6/ADC_CH3/UART0_TX                                   |
|        | JP6.13 | JP6.14 | 31        | P0.7/ADC_CH2/UART0_RX                                   |
|        | JP6.15 | JP6.16 | 32        | P3.4/PWM3_CH1/UART3_RX                                  |

Table 2.4-1 MS51PC0AE Full-pin Extension Connectors and GPIO Function List





## 2.5 System Configuration

### 2.5.1 VIN Power Source

Table 2.5-1 presents the Vin power source.

| Connector | Net Name in Schematic | Comment                                                                                                                                                                   |
|-----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NU1 pin8  | NU1_VIN               | Board external power source, with voltage range from 7 V to 12 V. The voltage regulator UP2 converts the NU1 pin8 input voltage to 5 V and supplies it to NuMaker-MS51PC. |

Table 2.5-1 Vin Power Source

### 2.5.2 5 V Power Sources

Table 2.5-2 presents the 5 V power sources.

| Connector | Net Name in Schematic | Comment                                                                                                                    |
|-----------|-----------------------|----------------------------------------------------------------------------------------------------------------------------|
| ICEJ3     | USB_HS_VBUS           | ICE USB connector supplies 5 V power from PC to MS51 platform and Nu-Link2-Me.                                             |
| J2        | USB_VBUS              | USB connector on NuMaker-MS51PC supplies 5 V power from PC to MS51 platform and Nu-Link2-Me.                               |
| NU1 pin5  | NU1_5VCC              | ICEJ3, J2 or NU1 pin8 supplies 5 V power to NU1 pin5. NU1 pin5 supplies 5 V power to target chip or Arduino adapter board. |

Table 2.5-2 5V Power Sources

### 2.5.3 3.3 V Power Sources

Table 2.5-3 presents the 3.3 V power sources.

| Voltage Regulator | 5V Source   | Comment                                                                                                                       |
|-------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------|
| ICEUP1            | USB_HS_VBUS | ICEUP1 converts USB_HS_VBUS to 3.3 V and supplies 3.3V to MS51 platform or ICE chip.                                          |
| UP1               | USB_VBUS    | UP1 converts USB_VBUS to 3.3 V and supplies 3.3 V to MS51 platform.<br><b>Note:</b> SW2.2(NU1 3VCC) should be switched to ON. |
| UP1               | NU1_5VCC    | UP1 converts NU1_5VCC to 3.3 V and supplies 3.3 V to MS51 platform.<br><b>Note:</b> SW2.2(NU1 3VCC) should be switched to ON. |

Table 2.5-3 3.3 V Power Sources

### 2.5.4 1.8V Power Sources

Table 2.5-4 presents the 1.8 V power source.



| Voltage Regular | 5V Source   | Comment                                                                             |
|-----------------|-------------|-------------------------------------------------------------------------------------|
| ICEUP2          | USB_HS_VBUS | ICEUP2 converts USB_HS_VBUS to 1.8V and supplies 1.8V to MS51 platform or ICE chip. |

Table 2.5-4 1.8V Power Sources

## 2.5.5 Power Connectors

Table 2.5-5 presents the power connectors.

| Connector | Comment                                                        |
|-----------|----------------------------------------------------------------|
| JP1       | V <sub>DD</sub> (2.4 V ~ 5 V) connector on the NuMaker-MS51PC. |
| JP2       | V <sub>SS</sub> connector on the NuMaker-MS51PC.               |

Table 2.5-5 Power Connectors

## 2.5.6 USB Connectors

Table 2.5-6 presents the USB connectors.

| Connector | Comment                                                                               |
|-----------|---------------------------------------------------------------------------------------|
| ICEJ3     | ICE USB connector on Nu-Link2-Me for power supply, debugging and programming from PC. |
| J2        | USB power connector on NuMaker-MS51PC for power supply.                               |

Table 2.5-6 USB Connectors

## 2.5.7 Power Switches

Table 2.5-7 presents the power switches.

| Switch  | Comment                                                              |
|---------|----------------------------------------------------------------------|
| ICEJPR1 | Configures the target chip operating voltage at 1.8 V / 3.3 V / 5 V. |
| ICEJPR2 | Configures the ICE chip operating voltage at 1.8 V / 3.3 V.          |
| SW2     | Configures the target chip operating voltage at 3.3 V / 5 V.         |

Table 2.5-7 Power Switches

## 2.5.8 Power Supply Models

### 2.5.8.1 External Power Supply through Nu-Link2-Me to Target Chip

The external power supply source on Nu-Link2-Me is shown in Figure 2.5-1.

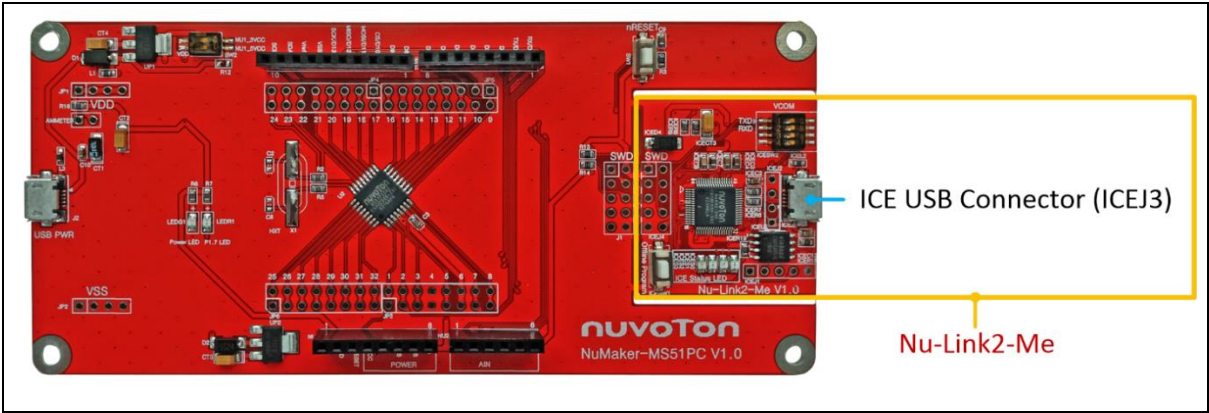


Figure 2.5-1 External Power Supply Sources on Nu-Link2-Me

To use ICEJ3 as external power supply source with Nu-Link2-Me, please follow the below steps:

- 1. Solder the resistor on ICEJPR1 (MCUVCC) depends on the target chip operating voltage.
- 2. Solder the resistor on ICEJPR2 (ICEVCC) depends on the ICE chip operating voltage.
- 3. Switch the SW2 to OFF.
- 4. Connect the external power supply to JP1.

Table 2.5-8 presents all power models when supplies external power through Nu-Link2-Me. The Nu-Link2-Me external power sources are highlighted in yellow.

| Model                                                                                                                                                                                                                   | Target Chip Voltage | ICEJ3         | ICEJPR1 (MCUVCC) Selection <sup>[1]</sup> | ICEJPR2 (ICEVCC) Selection <sup>[2]</sup> | ICE Chip Voltage | SW2 Selection | J2     | Vin    | JP1          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------|-------------------------------------------|-------------------------------------------|------------------|---------------|--------|--------|--------------|
| 1                                                                                                                                                                                                                       | 1.8 V               | Connect to PC | 1.8 V                                     | 1.8 V                                     | 1.8 V            | Off           | Ignore | Ignore | 1.8 V output |
| 2                                                                                                                                                                                                                       | 3.3 V               | Connect to PC | 3.3 V (default)                           | 3.3 V (default)                           | 3.3 V            | Off           | Ignore | Ignore | 3.3 V output |
| 3                                                                                                                                                                                                                       | 5 V                 | Connect to PC | 5V                                        | 3.3 V (default)                           | 3.3 V            | Off           | Ignore | Ignore | 5 V output   |
| <div>X: Unused.</div> <div>Note:</div> <div><div>1. 0 Ω should be soldered between ICEJPR1's MCVCC and 1.8 V / 3.3 V / 5 V.</div><div>2. 0 Ω should be soldered between ICEJPR2's ICEVCC and 1.8 V / 3.3 V.</div></div> |                     |               |                                           |                                           |                  |               |        |        |              |

Table 2.5-8 Supply External Power through Nu-Link2-Me

2.5.8.2 External Power Supply through MS51 platform to Target Chip

The external power supply sources on MS51 platform are shown in Figure 2.5-2.

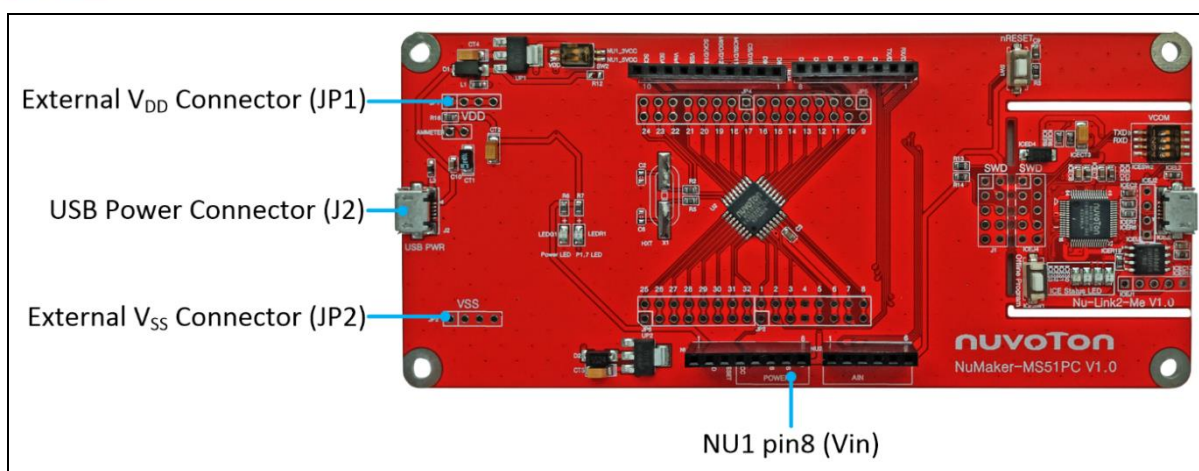


Figure 2.5-2 External Power Supply Sources on MS51 Platform

To use Vin or J2 as external power supply source, please follow the below steps:

1. Switch the SW2 depends on the target chip operating voltage.
2. Remove the resistor on ICEJPR1 (MCUVCC).
3. Solder the resistor on ICEJPR2 (ICEVCC) depends on the ICE chip operating voltage.
4. Connect the external power supply to Vin or J2.

To use JP1 as external power supply source, please follow the below steps:

1. Switch the SW2 to OFF.
2. Remove the resistor on ICEJPR1 (MCUVCC).
3. Solder the resistor on ICEJPR2 (ICEVCC) depends on the ICE chip operating voltage.
4. Connect ICEJ3 to PC.
5. Connect the external power supply to JP1.

To use Vin or J2 as external power supply source with Nu-Link2-Me separated from NuMaker-MS51PC, please follow the below steps:

1. Switch the SW2 depends on the target chip operating voltage.
2. Separate the Nu-Link2-Me from NuMaker-MS51PC.
3. Connect the external power supply to Vin or J2.

To use JP1 as external power supply source with Nu-Link2-Me separated from NuMaker-MS51PC, please follow the below steps:

1. Switch the SW2 to OFF.
2. Separate the Nu-Link2-Me from NuMaker-MS51PC.
3. Connect the external power supply to JP1.

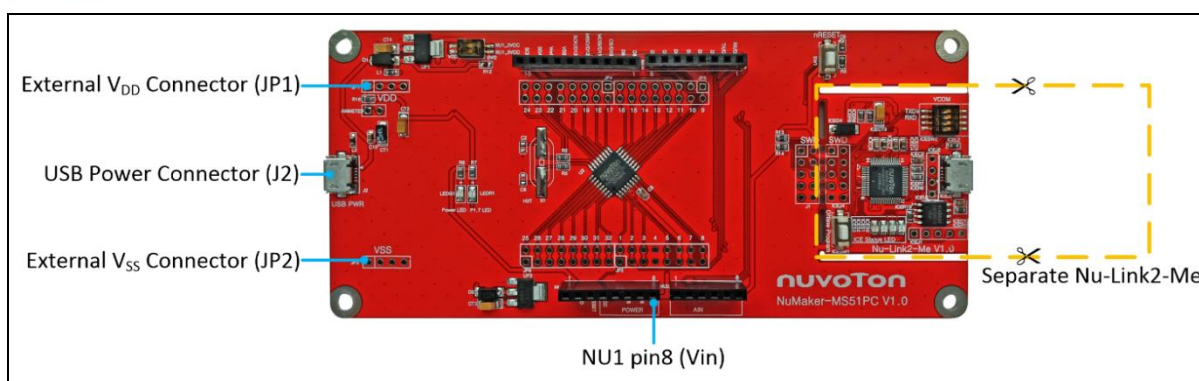


Figure 2.5-3 Separate the Nu-Link2-Me from NuMaker-MS51PC

Table 2.5-9 presents all power models when supplies external power through MS51 platform. The MS51 platform external power sources are highlighted in yellow.

| Model | Target Chip Voltage | Vin <sup>[1]</sup>    | J2                    | ICEJ3               | SW2 Selection | JP1                    | ICEJPR1 (MCUVCC) Selection <sup>[2]</sup> | ICEJPR2 (ICEVCC) Selection <sup>[3]</sup> | ICE Chip Voltage <sup>[4]</sup> |
|-------|---------------------|-----------------------|-----------------------|---------------------|---------------|------------------------|-------------------------------------------|-------------------------------------------|---------------------------------|
| 4     | 3.3 V               | 7 V ~ 12 V Input      | X                     | Ignore              | NU1 3VCC      | 3.3 V output           | Remove resistor                           | 3.3 V                                     | 3.3 V                           |
| 5     | 3.3 V               | X                     | Connect to PC         | Ignore              | NU1 3VCC      | 3.3 V output           | Remove resistor                           | 3.3 V                                     | 3.3 V                           |
| 6     | 5 V                 | 7 V ~ 12 V Input      | X                     | Ignore              | NU1 5VCC      | 5 V output             | Remove resistor                           | 3.3 V                                     | 3.3 V                           |
| 7     | 5 V                 | X                     | Connect to PC         | Ignore              | NU1 5VCC      | 5 V output             | Remove resistor                           | 3.3 V                                     | 3.3 V                           |
| 8     | 1.8 V ~ 3.6 V       | Ignore <sup>[5]</sup> | Ignore <sup>[5]</sup> | Connect to PC       | OFF           | DC Input 1.8 V ~ 3.6 V | Remove resistor                           | 1.8 V / 3.3 V                             | 1.8 V / 3.3 V                   |
| 9     | 1.8 V ~ 3.6 V       | Ignore <sup>[5]</sup> | Ignore <sup>[5]</sup> | Nu-Link2-Me removed | OFF           | DC Input 1.8 V ~ 3.6 V | X                                         | X                                         | X                               |

X: Unused.

**Note:**

- The Vin input voltage will be converted by voltage regulator UP2 to 5 V.
- 0Ω should be removed from ICEJPR1's MCVCC and 1.8 V / 3.3 V / 5 V.
- 0Ω should be soldered between ICEJPR2's ICEVCC and 1.8 V / 3.3 V.
- The ICE chip voltage should be close to the target chip voltage.
- JP1 external power input only provides voltage to target chip. Supply external power to Vin or J2 can provide 5V to NU1 pin5 (5V) and 3.3V to NU1 pin4 (3VCC).

Table 2.5-9 Supply External Power for MS51 platform

### 2.5.9 Ammeter Connector

Table 2.5-10 presents the ammeter connector.

| Connector | Comment                                                                                                        |
|-----------|----------------------------------------------------------------------------------------------------------------|
| AMMETER   | Connector for user to easily measure the target chip power consumption. User needs to remove the R16 resistor. |

Table 2.5-10 Ammeter Connector

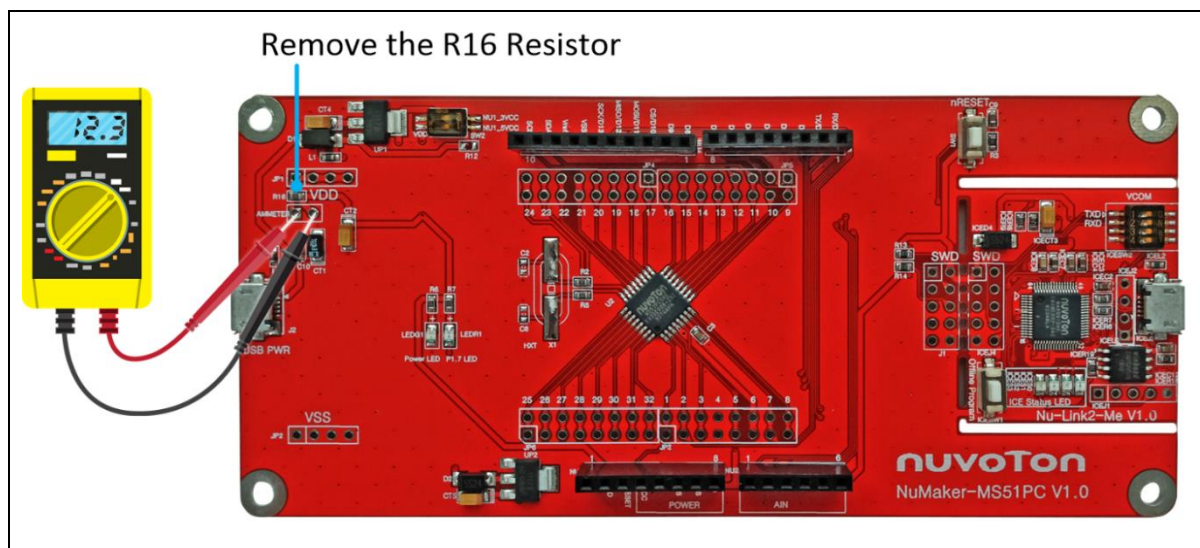


Figure 2.5-4 Wiring between Ammeter Connector and Ammeter

### 2.5.10 Extension Connectors

Table 2.5-11 presents the extension connectors.

| Connector             | Comment                                               |
|-----------------------|-------------------------------------------------------|
| JP3, JP4, JP5 and JP6 | Full pins extension connectors on the NuMaker-MS51PC. |
| NU1, NU2, NU3 and NU4 | Arduino UNO compatible pins on the NuMaker-MS51PC.    |

Table 2.5-11 Extension Connectors

### 2.5.11 Push-Buttons

Table 2.5-12 presents the push-buttons.

| Component | Comment                                                                |
|-----------|------------------------------------------------------------------------|
| ICESW1    | Off-line program button to start off-line programming the target chip. |
| SW1       | Reset button to reset the target chip.                                 |

Table 2.5-12 Push-Buttons

### 2.5.12 LEDs

Table 2.5-13 presents the LEDs.

| Component                        | Comment                                                     |
|----------------------------------|-------------------------------------------------------------|
| Power LED                        | The power LED indicates that the NuMaker-MS51PC is powered. |
| P3.5 LED                         | The LED which is connected to the target chip P3.5.         |
| ICES0, ICES1, ICES2<br>and ICES3 | Nu-Link2-Me status LED.                                     |

Table 2.5-13 LEDs



## 2.6 Nu-Link2-Me

The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through OCD interface. The on-board 16 Mbit SPI Flash allows it to off-line program the target microcontroller. Additionally, the Nu-Link2-Me provides virtual COM port (VCOM) function to print out messages on PC. Table 2.6-1 presents how to set the VCOM function by ICESW2.

| ICESW2                              |          |                                                                                                                                          |
|-------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------|
| Pin                                 | Function | Comment                                                                                                                                  |
| 1                                   | TXD      | <b>On:</b> Connect target chip PB.13 (UART0_TXD) to Nu-Link2-Me.<br><b>Off:</b> Disconnect target chip PB.13 (UART0_TXD) to Nu-Link2-Me. |
| 2                                   | RXD      | <b>On:</b> Connect target chip PB.12 (UART0_RXD) to Nu-Link2-Me.<br><b>Off:</b> Disconnect target chip PB.12 (UART0_RXD) to Nu-Link2-Me. |
| <b>Note:</b> Pin 3 and 4 is unused. |          |                                                                                                                                          |

Table 2.6-1 VCOM Function of Nu-Link2-Me

Figure 2.7-1 and Figure 2.7-2 show the front and rear placement of NuMaker-M51PC.





### 3 QUICK START

#### 3.1 Toolchains Supporting

Install the preferred toolchain. Please make sure at least one of the toolchains has been installed.

[KEIL C51](#)

[IAR EW8051](#)

### 3.2 Nuvoton Nu-Link Driver Installation

Download and install the latest Nuvoton Nu-Link Driver. Please install the Nu-Link USB Driver as well at the end of the installation.

- [Download and install Nu-Link Keil Driver when using Keil C51.](#)
- [Download and install Nu-Link IAR Driver when using IAR EW8051.](#)

Please install the Nu-Link USB Driver as well at the end of the installation. The installation is presented in Figure 3.2-1 and Figure 3.2-2.

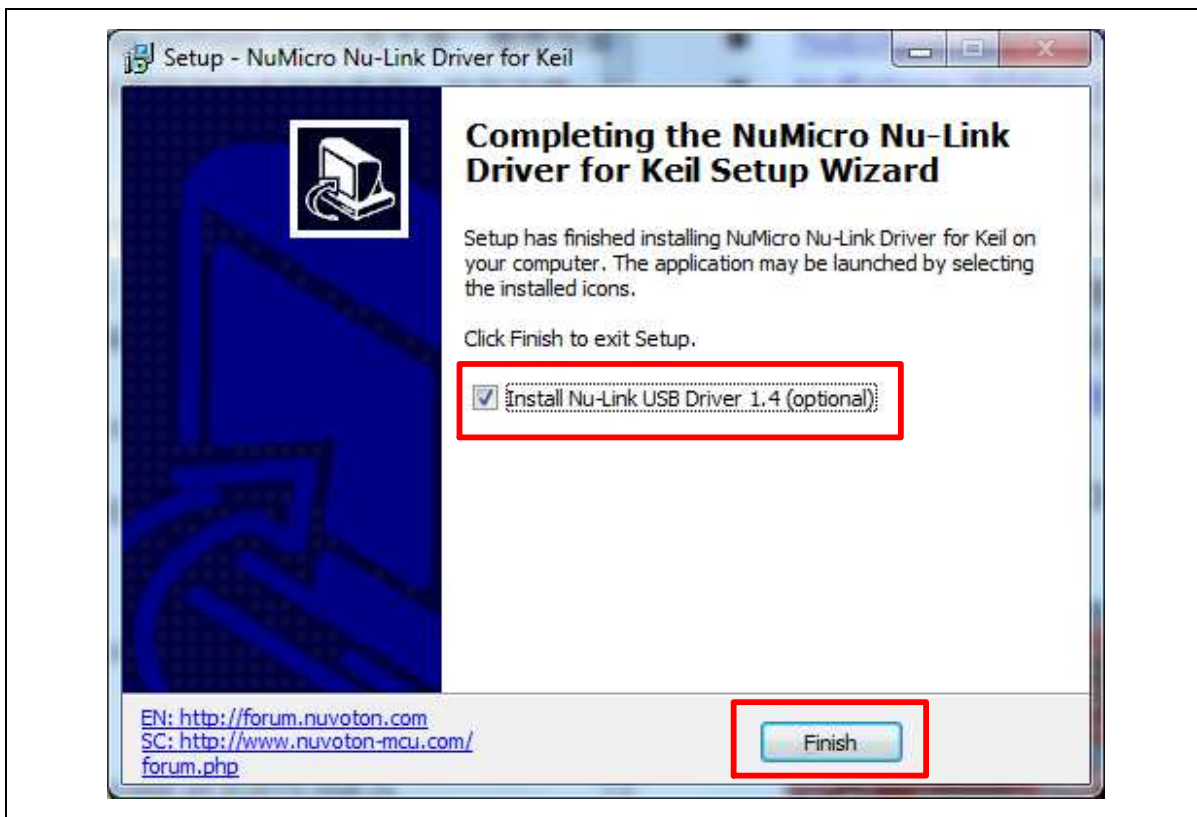


Figure 3.2-1 Nu-Link USB Driver Installation Setup



Figure 3.2-2 Nu-Link USB Driver Installation

### 3.3 BSP Firmware Download

Download and unzip the Board Support Package (BSP).

- [Download and unzip MS51 Series BSP Keil when using Keil C51.](#)
- [Download and unzip MS51 Series BSP IAR when using IAR EW8051.](#)

### 3.4 Hardware Setup

1. Open the virtual COM (VCOM) function by changing Nu-Link2-Me VCOM Switch No. 1 and 2 to ON.



Figure 3.4-1 Open VCOM Function

2. Connect the ICE USB connector shown in Figure 3.4-2 to the PC USB port through USB cable.

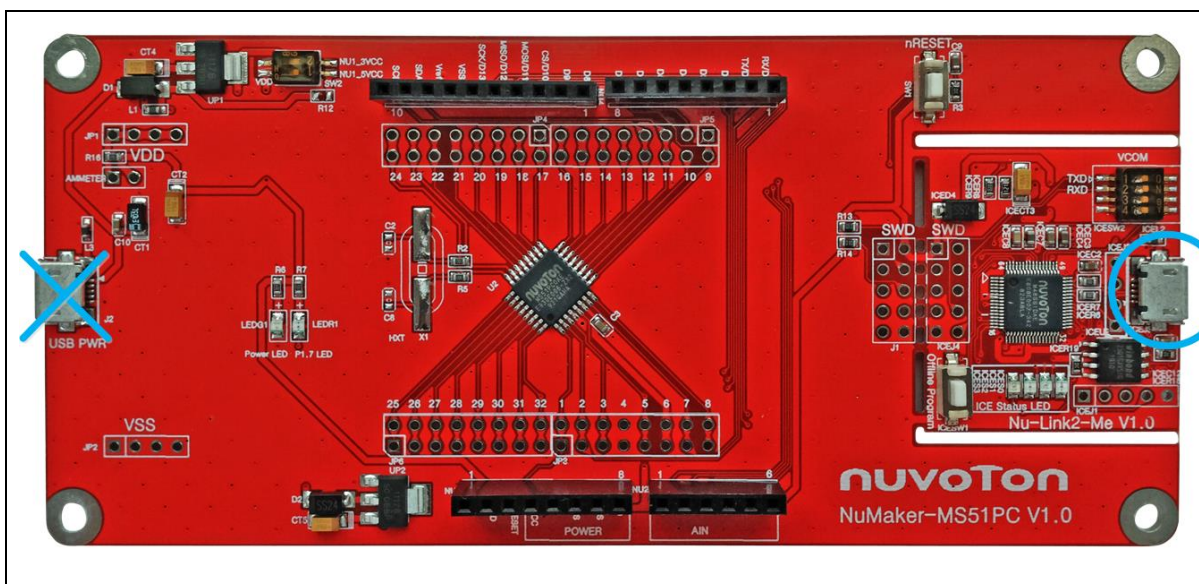


Figure 3.4-2 ICE USB Connector

3. Find the “Nuvoton Virtual COM Port” on the Device Manager as Figure 3.4-3.



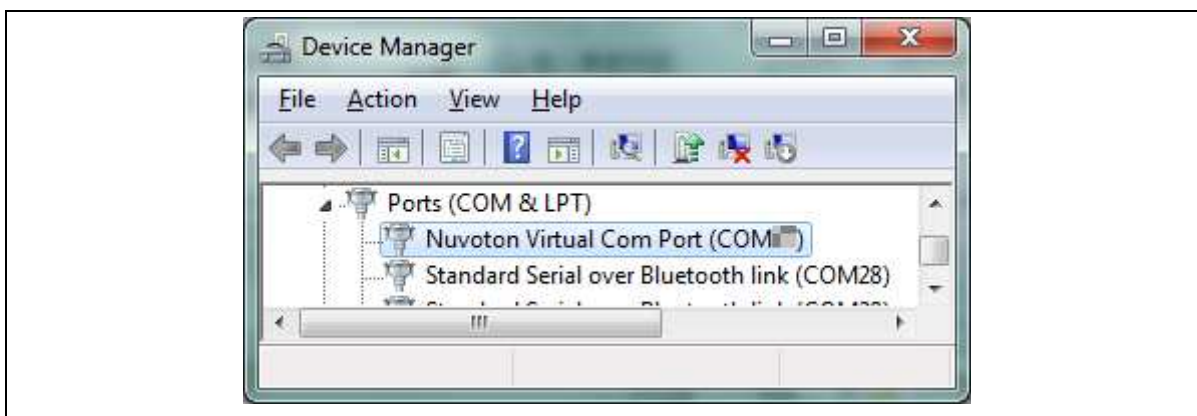


Figure 3.4-3 Device Manger

4. Open a serial port terminal, PuTTY for example, to print out debug message. Set the speed to 115200. Figure 3.4-4 presents the PuTTY session setting.

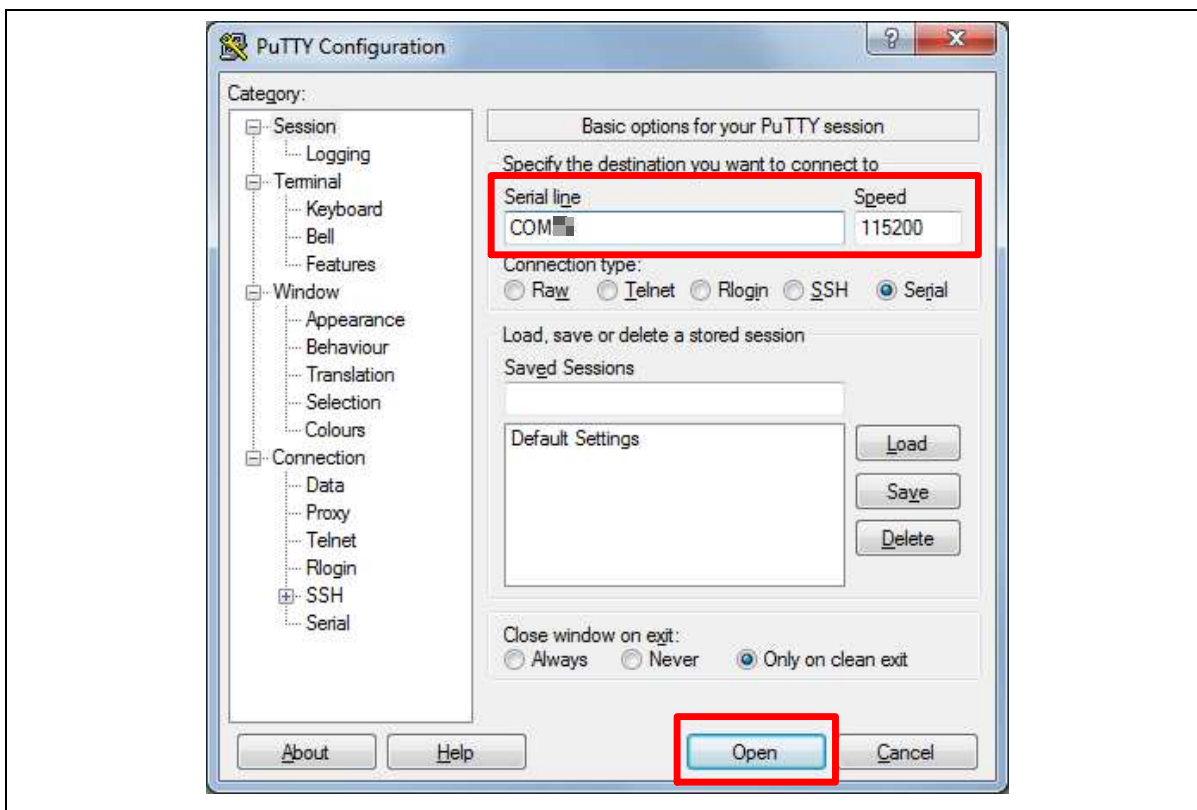


Figure 3.4-4 PuTTY Session Setting

### 3.5 Find the Example Project

Use the “Template” project as an example. The project can be found under the BSP folder as shown:

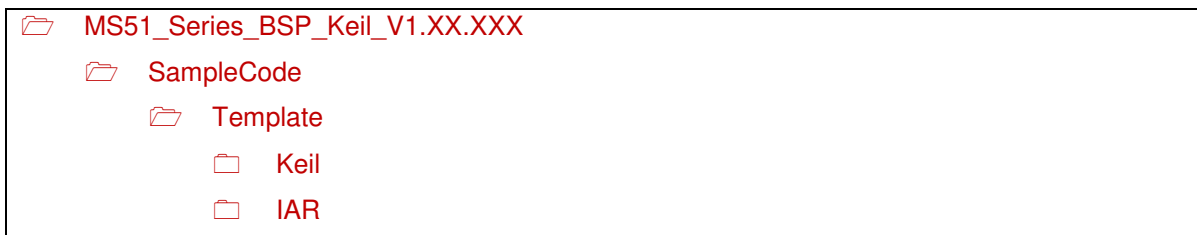


Figure 3-5 Template Project Folder Path

### 3.6 Execute the Project under Toolchains

Open and execute the project under the toolchain. The section 3.6.1, 3.6.2 describe the steps of executing project in Keil PK51, IAR EW8051 respectively.

#### 3.6.1 Keil PK51

This section provides steps to beginners on how to run a project by using Keil PK51.

Double click the “Template.uvproj” to open the project.

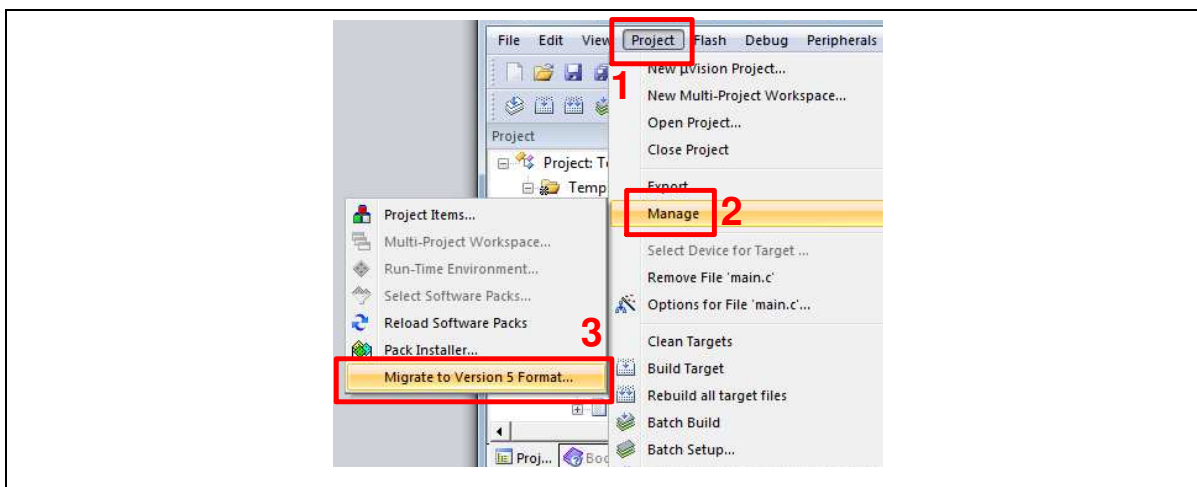


Figure 3.6-1 Project File Migrate to Version 5 Format

1. Make sure the debugger is “Nuvoton Nu-Link Debugger” as shown in Figure 3.6-2 and Figure 3.6-3.

**Note:** If the dropdown menu in Figure 3.6-2 does not contain “Nuvoton Nu-Link Debugger” item, please rework section 3.6.1.

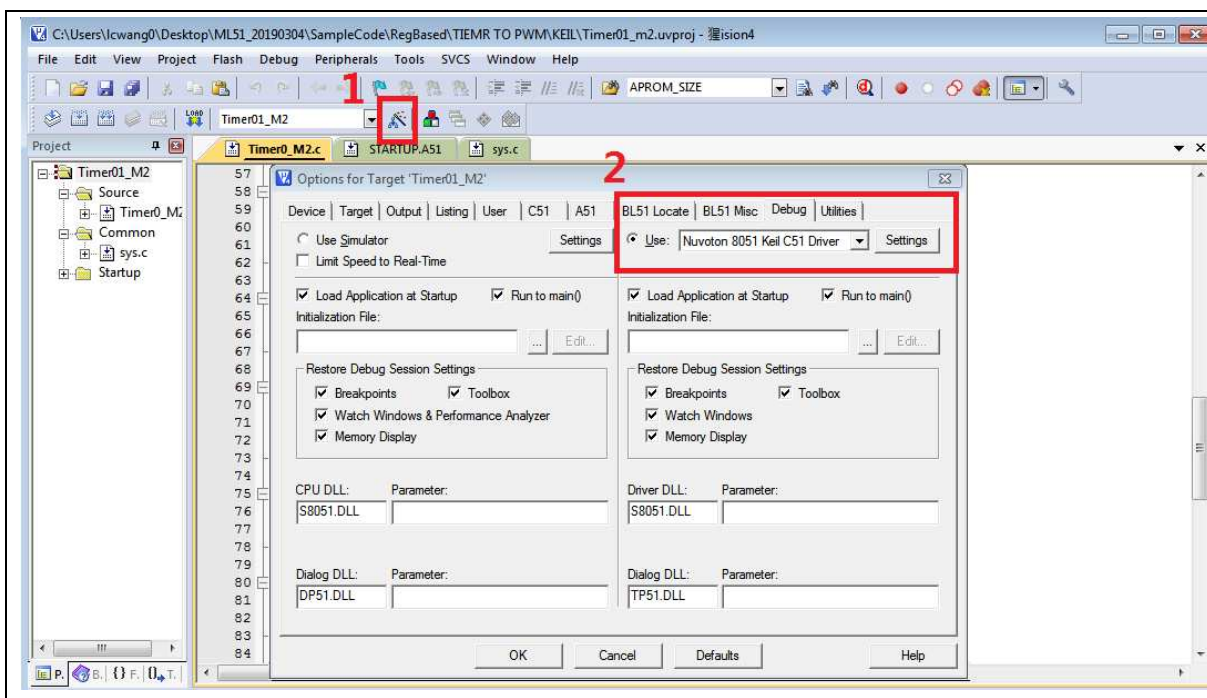


Figure 3.6-2 Debugger Setting in Options Window



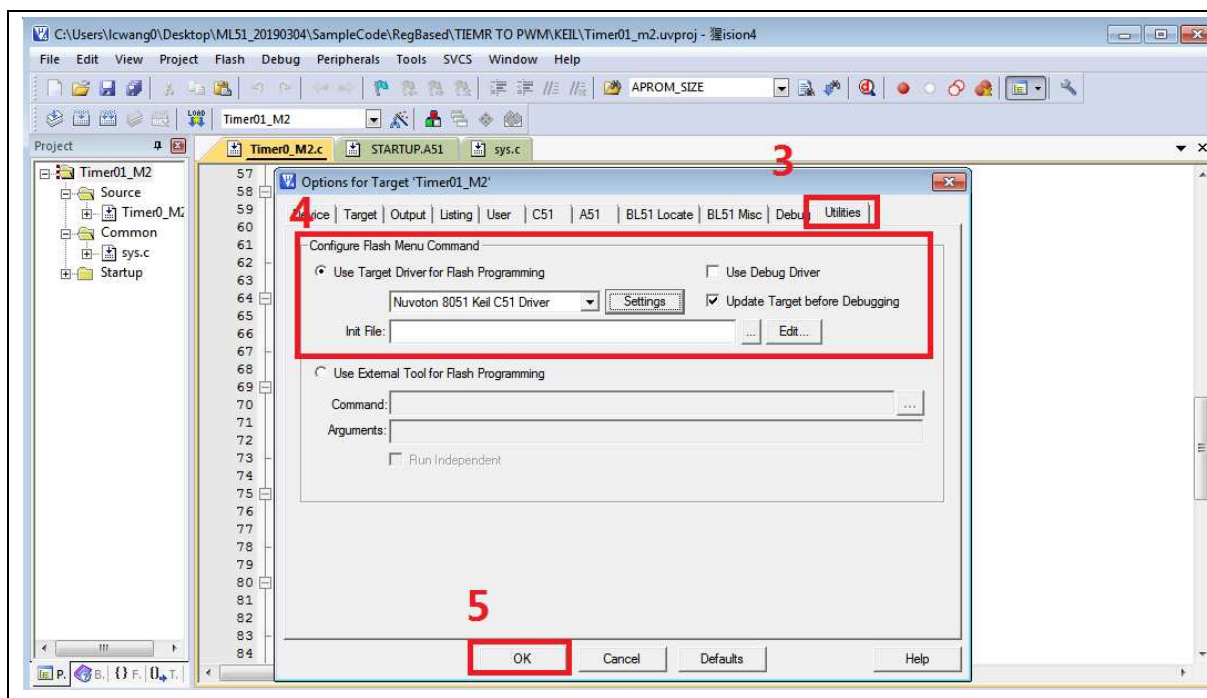


Figure 3.6-3 Programming Setting in Options Window

2. Rebuild all target files. After successfully compile the project, download code to the flash memory. Click "Start/Stop Debug Section" button can enter debug mode.

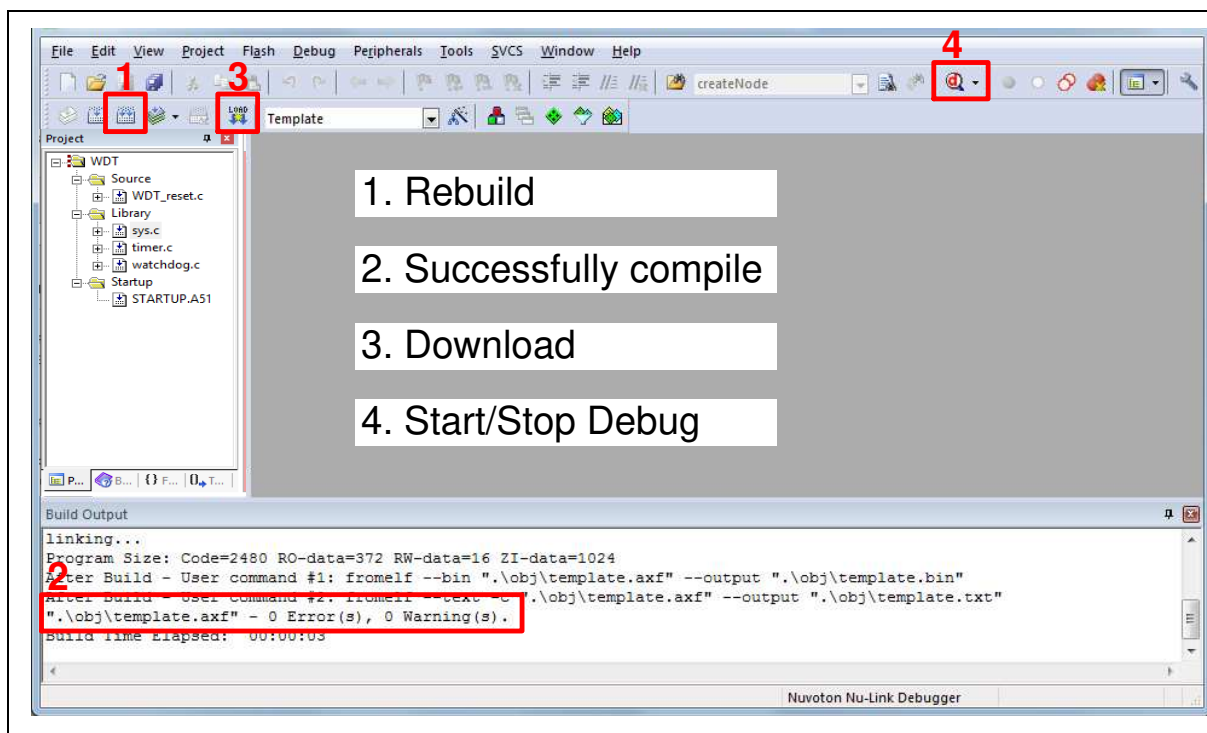


Figure 3.6-4 Compile and Download the Project

3. Figure 3.6-5 shows the debug mode under Keil MDK. Click "Run" and the debug message will be printed out as shown in Figure 3.6-6. User can debug the project under debug mode by checking

source code, assembly language, peripherals' registers, and setting breakpoint, step run, value monitor, etc.

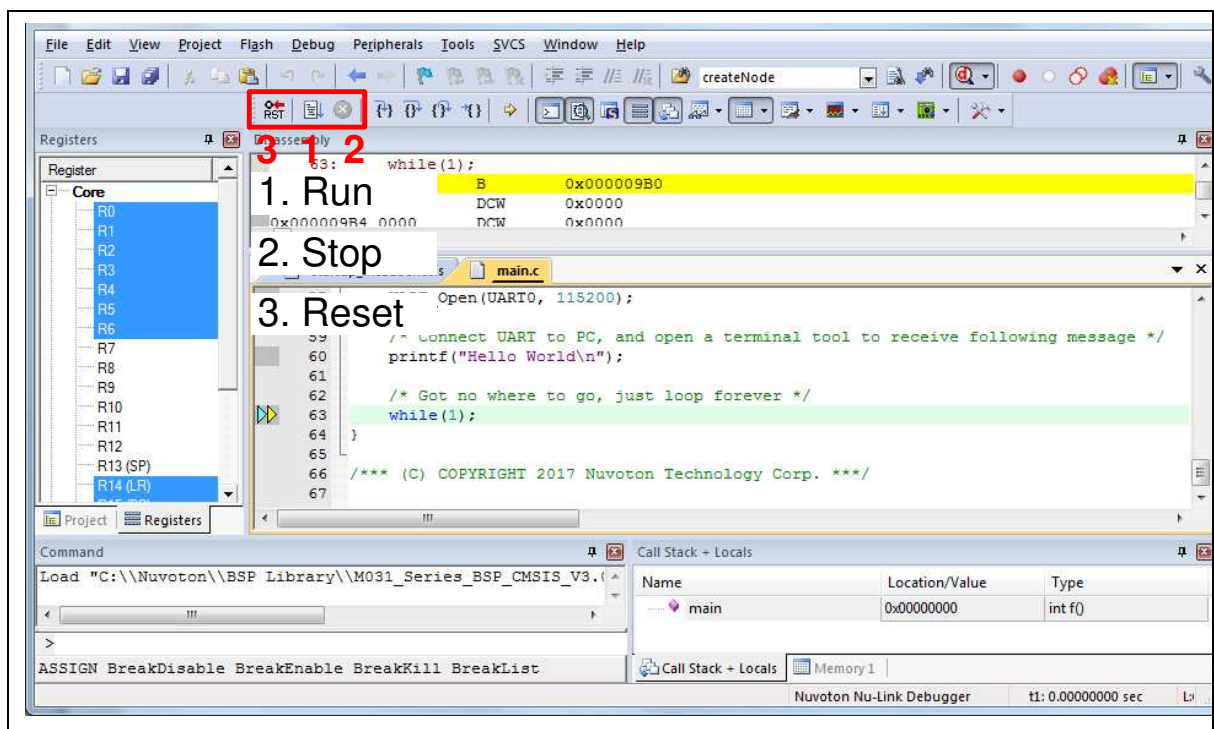


Figure 3.6-5 Keil MDK Debug Mode



Figure 3.6-6 Debug Message on Serial Port Terminal Windows

### 3.6.2 IAR EW8051

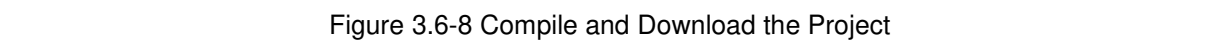
This section provides steps to beginners on how to run a project by using IAR EW8051.

1. Double click the "Template.eww" to open the project.
2. Make sure the toolbar contain "Nu-Link" item as shown in Figure 3.6-7.

**Note:** If the toolbar does not contain "Nu-Link" item, please rework section 0.



3. Make target file as presented in Figure 3.6-8. After successfully compile the project, download code to the flash memory and enter debug mode.



- Figure 3.6-9 shows the debug mode under IAR EW8051. Click “Go” and the debug message will be printed out as shown in Figure 3.6-10. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc.

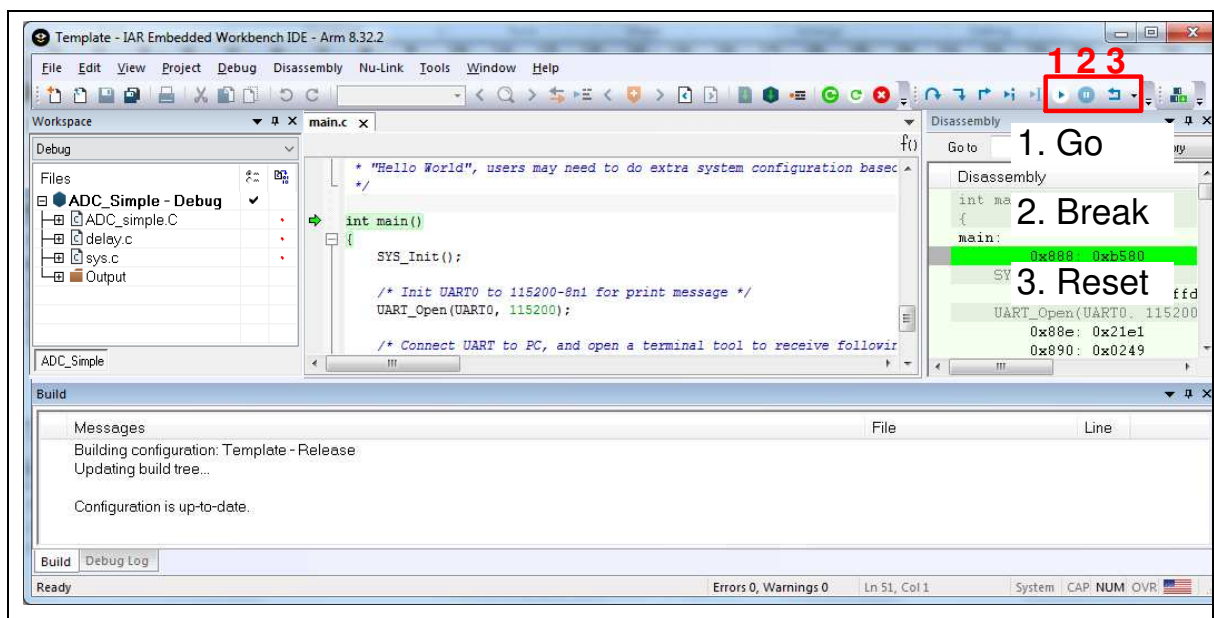


Figure 3.6-9 IAR EW8051 Debug Mode



Figure 3.6-10 Debug Message on Serial Port Terminal Windows

## 4 NUMAKER-MS51PC SCHEMATICS

### 4.1 Nu-Link2-Me

Figure 4.1-1 shows the Nu-Link2-Me circuit. The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through OCD interface.

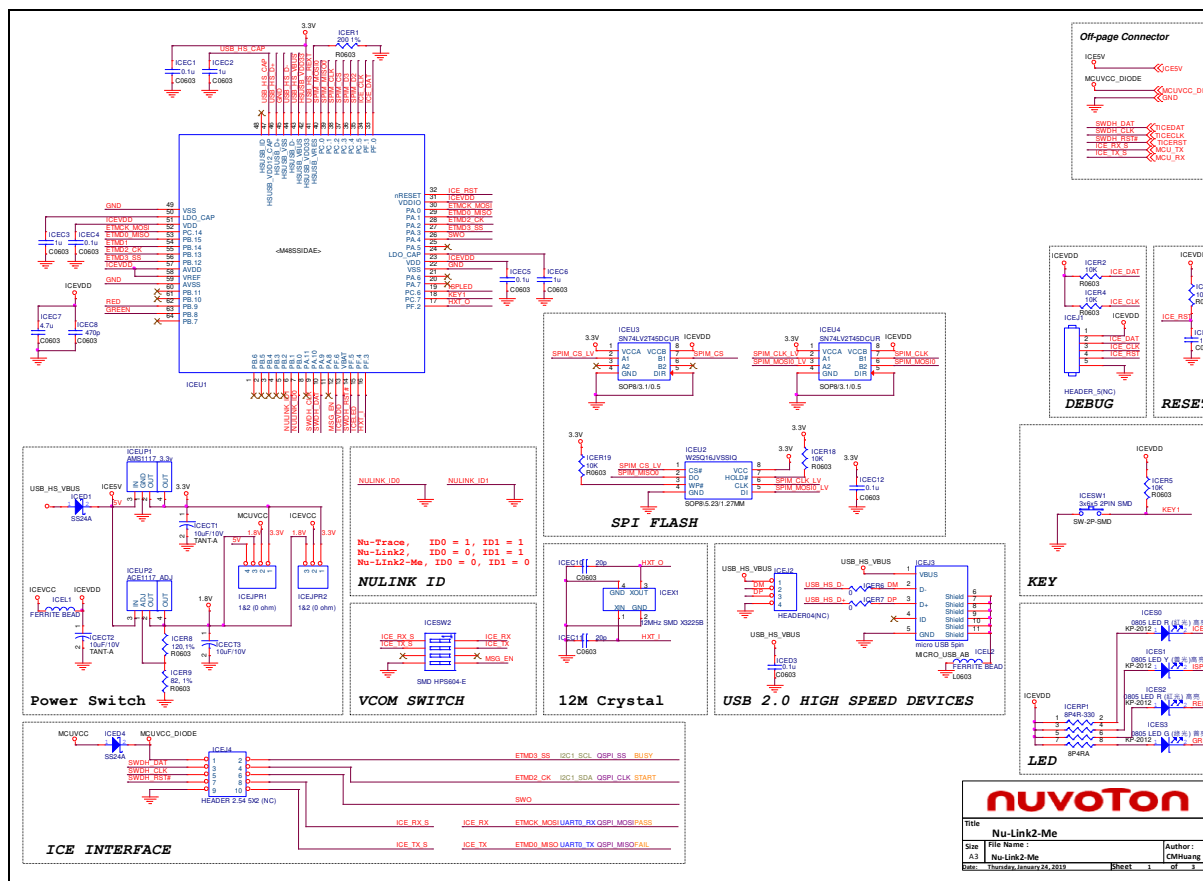


Figure 4.1-1 Nu-Link2-Me Circuit

## 4.2 MS51 Platform

Figure 4.2-1 shows the MS51 platform circuit.

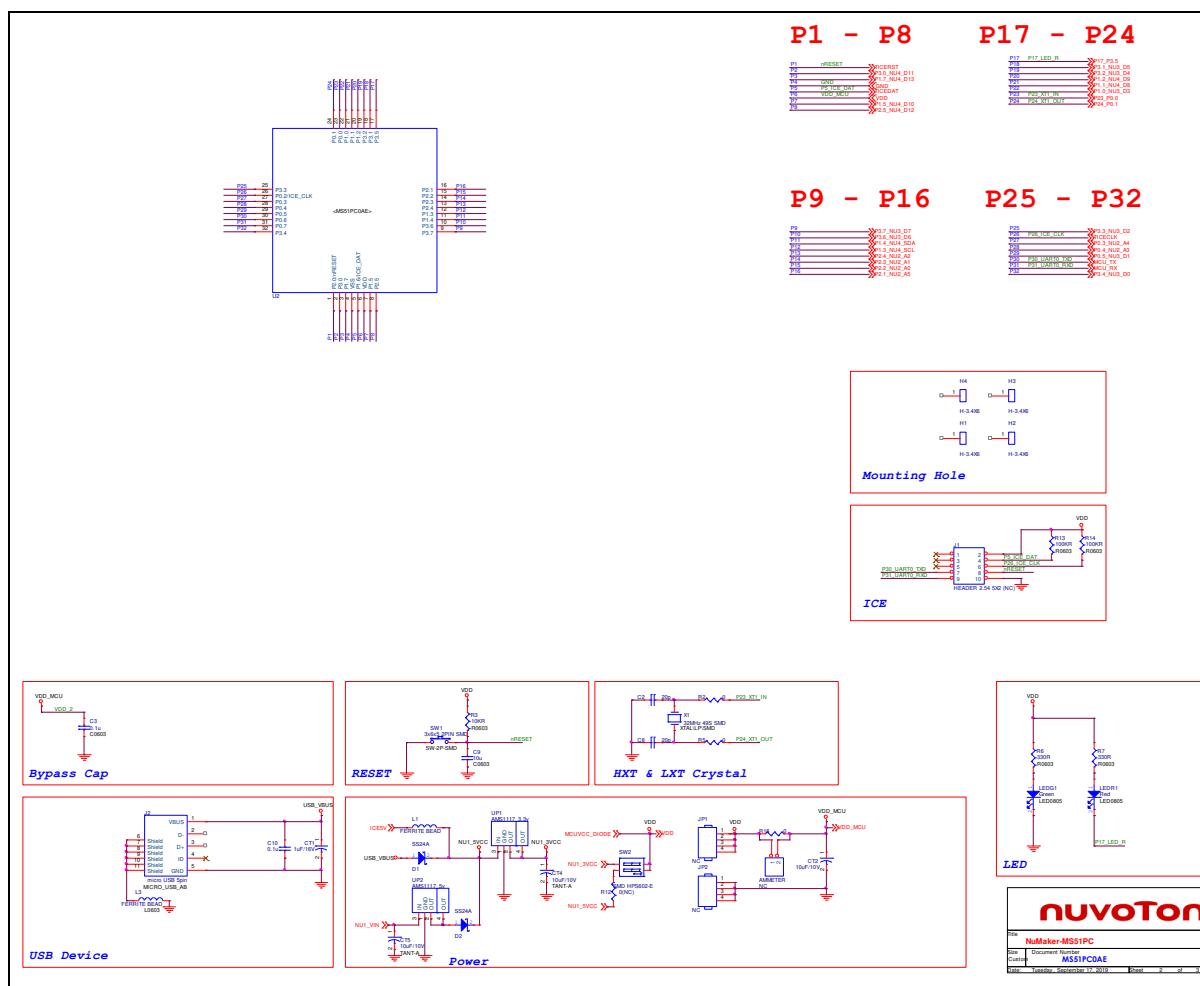


Figure 4.2-1 MS51 Platform Circuit

Figure 4.3-1 shows extension connectors of NuMaker-MS51PC.

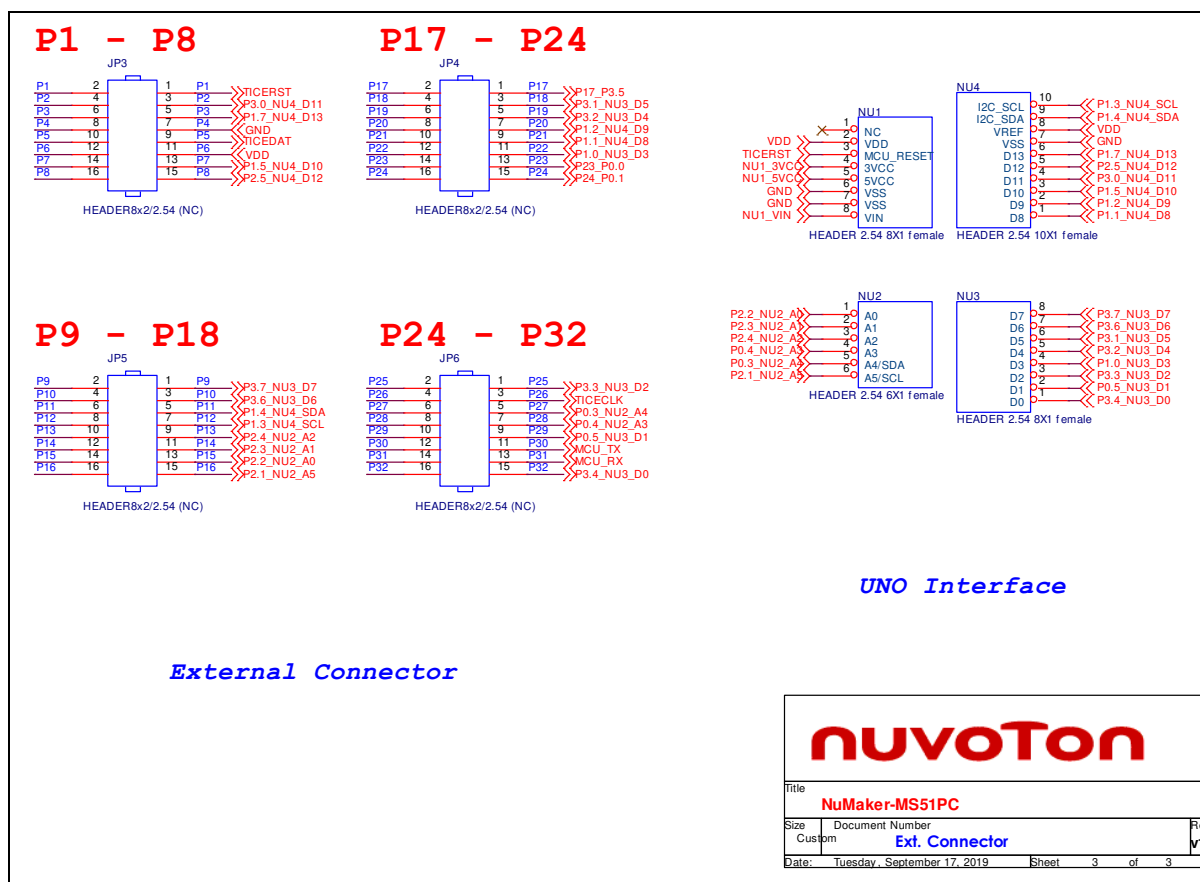


Figure 4.3-1 Extension Connectors Circuit



## 5 REVISION HISTORY

| Date       | Revision | Description      |
|------------|----------|------------------|
| 2019.08.30 | 1.00     | Initial Release. |

### Important Notice

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