

NuMicro[®] Family
Arm[®] Cortex[®] -M23-based Microcontroller

NuMaker-M256SD
User Manual

Evaluation Board for NuMicro[®] M254/256/258 Series

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Table of Contents

1 OVERVIEW 7

2 FEATURES 8

3 HARDWARE CONFIGURATION 9

 3.1 Front View..... 9

 3.2 Rear View 10

 3.3 Extension Connectors..... 11

 3.3.1 Pin Assignment for Extension Connectors11

 3.3.2 NuMaker-TNLCDSUB_M256SD Compatible Extension Connectors14

 3.3.3 Arduino UNO Compatible Extension Connectors16

 3.4 Power Supply Configuration 18

 3.4.1 VIN Power Source18

 3.4.2 5 V Power Sources18

 3.4.3 3.3 V Power Sources19

 3.4.4 1.8 V Power Sources19

 3.4.5 Power Connectors19

 3.4.6 USB Connectors20

 3.4.7 Power Switches20

 3.4.8 Power Supply Models20

 3.5 External Reference Voltage Connector..... 24

 3.6 Ammeter Connector 24

 3.7 Touch Key 24

 3.8 Push Buttons 25

 3.9 LEDs 25

 3.10 LCD Panel 26

 3.11 Nu-Link2-Me 28

 3.11.1 VCOM Switches.....28

 3.11.2 Status LEDs29

4 QUICK START 30

 4.1 Toolchains Supporting 30

 4.2 Nuvoton Nu-Link Driver Installation 30

 4.3 BSP Firmware Download 32

 4.4 Hardware Setup 32

 4.5 Find the Example Project 34

 4.6 Execute the Project under Toolchains 34

 4.6.1 Keil MDK34

4.6.2 IAR EWARM.....38

4.6.3 NuEclipse.....39

5 NUMAKER-M256SD SCHEMATICS 46

5.1 Nu-Link2-Me..... 46

5.2 M256SD Target Board 47

5.3 Extension Connectors..... 48

5.4 Touch Key..... 49

5.5 PCB Placement 50

6 REVISION HISTORY 51

List of Figures

Figure 1-1 NuMaker-M256SD Evaluation Board 7

Figure 3-1 Front View of NuMaker-M256SD..... 9

Figure 3-2 Rear View of NuMaker-M256SD 10

Figure 3-3 M256SD2AE Extension Connectors..... 11

Figure 3-4 Arduino UNO Compatible Extension Connectors..... 16

Figure 3-5 External Power Supply Sources on Nu-Link2-Me 20

Figure 3-6 External Power Supply Sources on M256SD Target Board..... 21

Figure 3-7 Detach the Nu-Link2-Me from NuMaker-M256SD 22

Figure 3-8 Wiring between Ammeter Connector and Ammeter..... 24

Figure 3-9 LCD Digit Segment Mapping 26

Figure 4-1 Nu-Link USB Driver Installation Setup..... 30

Figure 4-2 Nu-Link USB Driver Installation 31

Figure 4-3 Open VCOM Function 32

Figure 4-4 ICE USB Connector..... 32

Figure 4-5 Device Manger..... 33

Figure 4-6 PuTTY Session Setting..... 33

Figure 4-7 Template Project Folder Path..... 34

Figure 4-8 Warning Message of “Device not found” 34

Figure 4-9 Project File Migrate to Version 5 Format..... 35

Figure 4-10 Debugger Setting in Options Window..... 35

Figure 4-11 Programming Setting in Options Window..... 36

Figure 4-12 Compile and Download the Project 36

Figure 4-13 Keil MDK Debug Mode 37

Figure 4-14 Debug Message on Serial Port Terminal Windows..... 37

Figure 4-15 IAR EWARM Window 38

Figure 4-16 Compile and Download the Project 38

Figure 4-17 IAR EWARM Debug Mode 39

Figure 4-18 Debug Message on Serial Port Terminal Windows..... 39

Figure 4-19 Import the Project in NuEclipse 40

Figure 4-20 Import Projects Windows..... 40

Figure 4-21 Open Project Properties Window 41

Figure 4-22 Project Properties Settings 41

Figure 4-23 Build Project..... 42

Figure 4-24 Open Debug Configuration..... 42

Figure 4-25 Main Tab Configuration 43

Figure 4-26 Debugger Tab Configuration 43

Figure 4-27 Startup Tab Configuration 44

Figure 4-28 NuEclipse Debug Mode 45

Figure 4-29 Debug Message on Serial Port Terminal Windows..... 45

Figure 5-1 Nu-Link2-Me Circuit 46

Figure 5-2 M256SD Target Board Circuit 47

Figure 5-3 Extension Connectors Circuit 48

Figure 5-4 Touch Key Circuit 49

Figure 5-5 Front Placement 50

Figure 5-6 Rear Placement 50

List of Tables

Table 3-1 Extension Connectors..... 11

Table 3-2 M256SD2AE Full-pin Extension Connectors and GPIO Function List 13

Table 3-3 NuMaker-TNLCDSUB_M256SD Extension Connectors and M256SD2AE Mapping GPIO List..... 15

Table 3-4 Arduino UNO Extension Connectors and M256SD2AE Mapping GPIO List..... 17

Table 3-5 Vin Power Source 18

Table 3-6 5 V Power Sources 18

Table 3-7 3.3 V Power Sources 19

Table 3-8 1.8 V Power Sources 19

Table 3-9 Power Connectors 19

Table 3-10 USB Connectors 20

Table 3-11 Power Switches 20

Table 3-12 Supply External Power through Nu-Link2-Me 21

Table 3-13 Supply External Power for M256SD Target Board 23

Table 3-14 External Reference Voltage Connector 24

Table 3-15 Ammeter Connector 24

Table 3-16 Touch Key..... 24

Table 3-17 Push Buttons..... 25

Table 3-18 LEDs 25

Table 3-19 LCD Specifications..... 26

Table 3-20 LCD Pin Mapping Table..... 27

Table 3-21 VCOM Function of Nu-Link2-Me..... 28

Table 3-22 Operation Status LED Patterns 29

1 OVERVIEW

The NuMaker-M256SD is an evaluation board for Nuvoton NuMicro M254MD2AE, M254SD2AE, M256SD2AE and M256MD2AE microcontrollers with COM/SEG LCD driver and capacitive touch key sensing function. The NuMaker-M256SD consists of two parts: an M256SD target board and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-M256SD is designed for project evaluation, prototype development and validation with power consumption monitoring function.

The M256SD target board is based on NuMicro M256SD2AE to evaluate the capacitive touch key sensing function on the touch key TK1 with messages displayed on a HTN-LCD panel for Human Machine Interface applications. For developing touch key system and fine tuning associated environment variables easily to adjust sensitivity of the touch key, Nuvoton provides NuTool – NuSenadj to set hardware and software parameters automatically. For the development flexibility, the M256SD target board provides the extension connectors, the Arduino UNO compatible headers and the capability of adopting multiple power supplies. Furthermore, the Nuvoton-designed ammeter connector can measure the power consumption instantly, which is essential for the prototype evaluation.

In addition, there is an attached on-board debugger and programmer “Nu-Link2-Me”. The Nu-Link2-Me supports on-chip debugging, online and offline ICP programming via SWD interface. The Nu-Link2-Me supports virtual COM (VCOM) port for printing debug messages on PC. Besides, the programming status could be shown on the built-in LEDs. Lastly, the Nu-Link2-Me could be detached from the evaluation board and become a stand-alone mass production programmer.

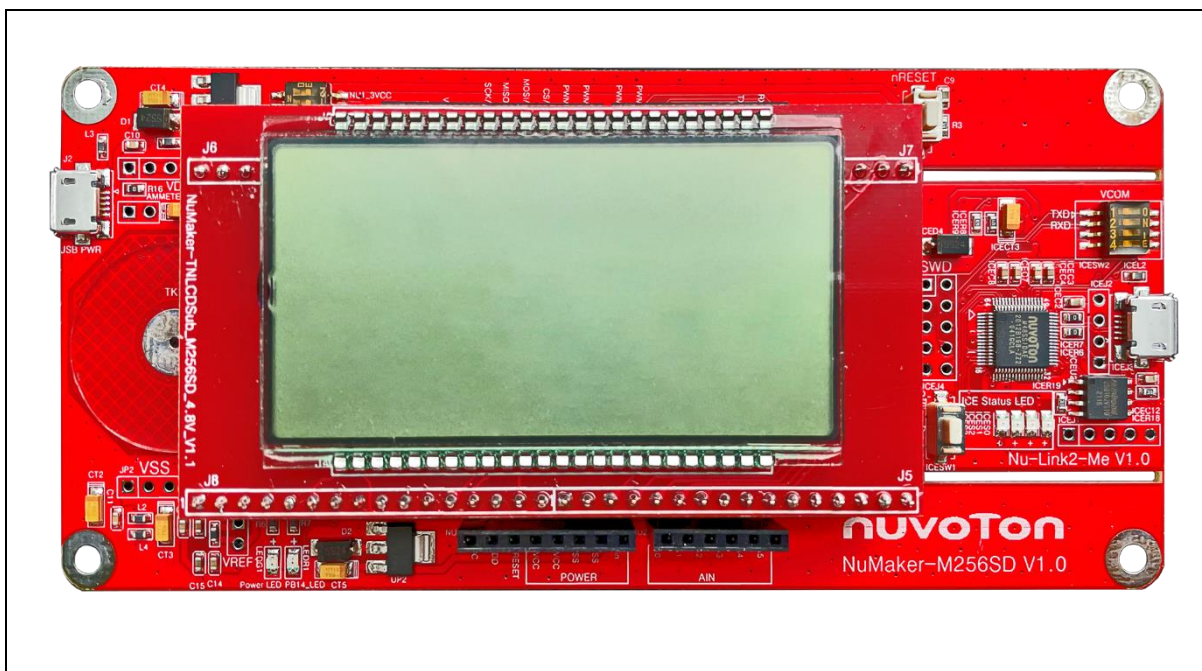


Figure 1-1 NuMaker-M256SD Evaluation Board

2 FEATURES

- NuMicro M256SD2AE used as main microcontroller with function compatible with:
 - M254MD2AE
 - M254SD2AE
 - M256MD2AE
- M256SD2AE full pins extension connectors
 - HTN-LCD panel can be plugged into extension connectors
- Arduino UNO compatible extension connectors
- Ammeter connector for measuring the microcontroller's power consumption
- Flexible board power supply:
 - External V_{DD} power connector
 - Arduino UNO compatible extension connector V_{in}
 - USB power connector on M256SD target board
 - ICE USB connector on Nu-Link2-Me
- Supports one touch key on board
 - Equipped with 1 touch key + reference pad + shielding electrode
 - Provides NuTool – NuSenadj to set hardware and software parameters automatically
- Supports HTN-LCD panel on NuMaker-TNLCDSUB_M256SD
 - 1/4 bias, 1/8 duty, 8 x 26 COM/SEG
- On-board Nu-Link2-Me debugger and programmer:
 - Debug through SWD interface
 - Online/offline programming
 - Virtual COM port function

3 HARDWARE CONFIGURATION

3.1 Front View

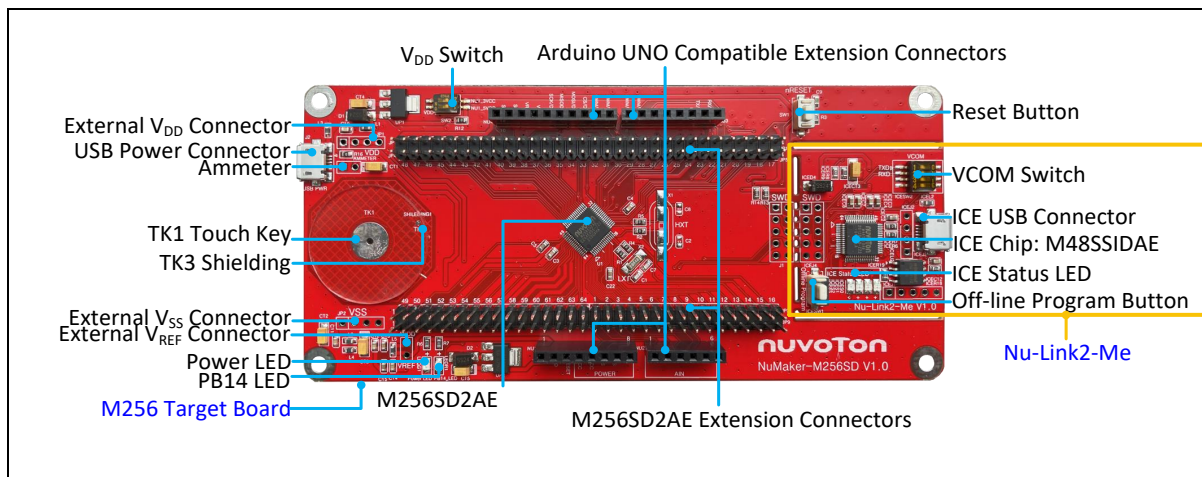


Figure 3-1 Front View of NuMaker-M256SD

Figure 3-1 shows the main components and connectors from the front side of NuMaker-M256SD. The following lists components and connectors from the front view:

- Target chip: M256SD2AE (U1)
- USB Power Connector (J2)
- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)
- M256 Extension Connectors (JP3, JP4, JP5, JP6, JP7, JP8, JP9 and JP10)
- External V_{DD} Power Connector (JP1)
- External V_{SS} Power Connector (JP2)
- External V_{REF} Connector (VREF1)
- V_{DD} Switch (SW2)
- Ammeter Connector (AMMETER)
- Reset Button (SW1)
- Power LED and PB14 LED (LEDG1 and LEDR1)
- Nu-Link2-Me
 - VCOM Switch
 - ICE Chip: M48SSIDAE (ICEU2)
 - ICE USB Connector (ICEJ3)
 - ICE Status LED (ICES0, ICES1, ICES2, ICES3)
 - Offline Program Button (ICESW1)

3.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-M256SD.

The following lists components and connectors from the rear view:

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

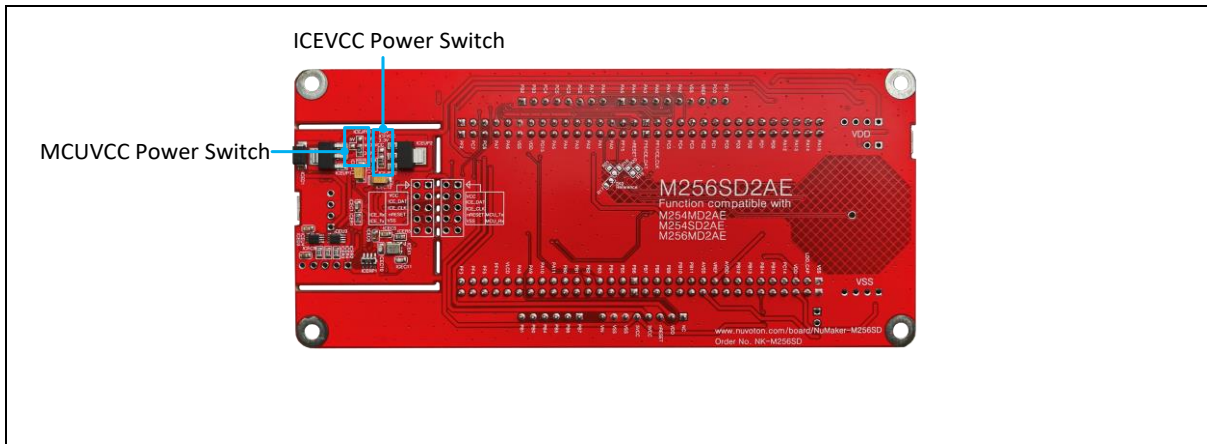


Figure 3-2 Rear View of NuMaker-M256SD

3.3 Extension Connectors

Table 3-1 presents the extension connectors.

| Connector | Description |
|--|---|
| JP3, JP4, JP5, JP6, JP7, JP8, JP9 and JP10 | Full pins extension connectors on the NuMaker-M256SD. |
| NU1, NU2, NU3 and NU4 | Arduino UNO compatible pins on the NuMaker-M256SD. |

Table 3-1 Extension Connectors

3.3.1 Pin Assignment for Extension Connectors

The NuMaker-M256SD provides the M256SD2AE onboard and extension connectors (JP3, JP4, JP5, JP6, JP7, JP8, JP9 and JP10). Figure 3-3 shows the M256SD2AE extension connectors.

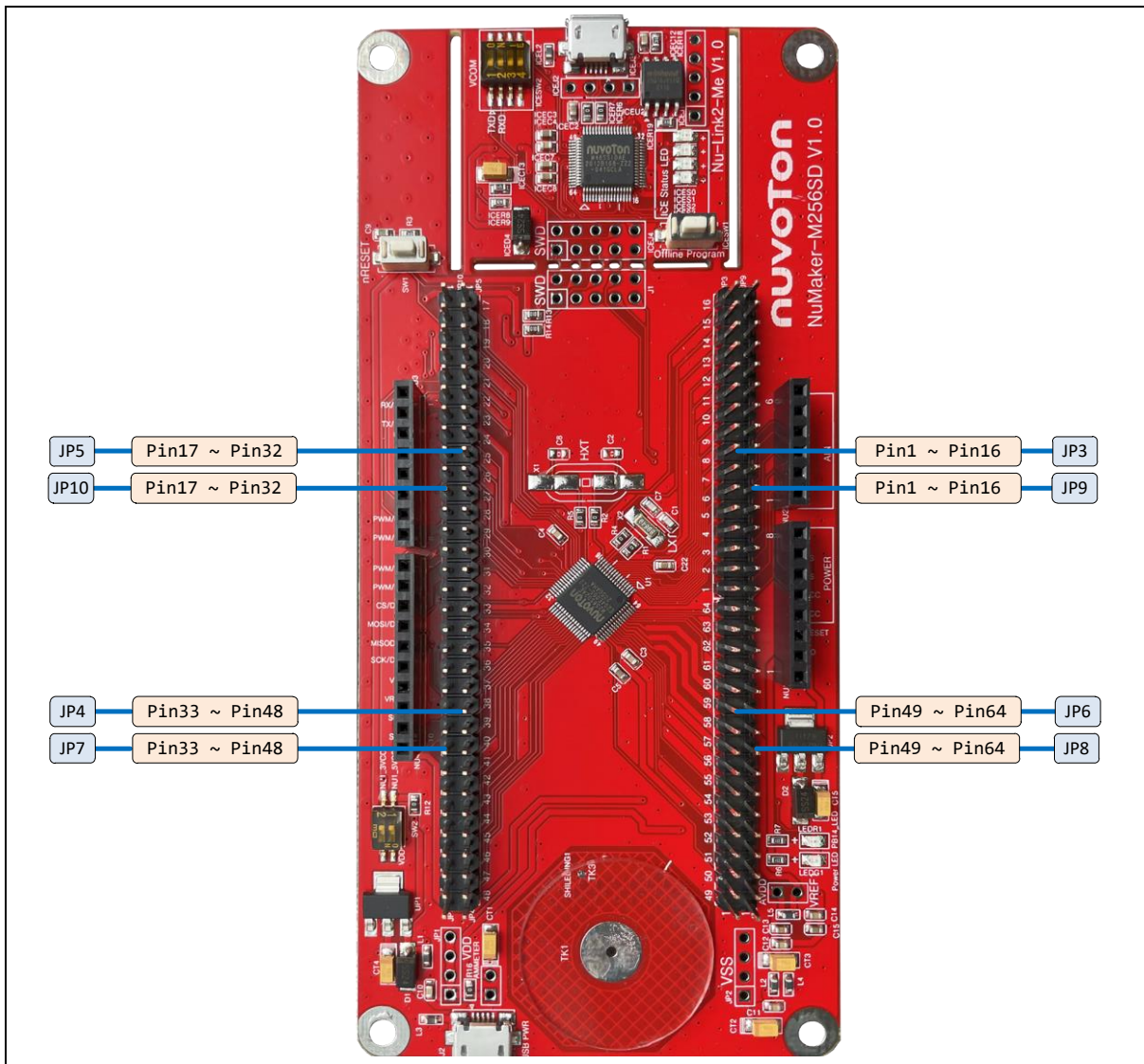


Figure 3-3 M256SD2AE Extension Connectors

| Header | | | M256SD2AE | |
|-------------|--------|---------|-----------|--|
| | | | Pin No. | Function |
| JP3 JP9 | JP3.1 | JP9.1 | 1 | PB.6/EADC0_CH6/UART1_RXD/LCD_SEG4/INT4/ACMP1_O |
| | JP3.2 | JP9.2 | 2 | PB.5/EADC0_CH5/ACMP1_N/LCD_COM0/I2C0_SCL/SC0_CLK/UART2_TXD/TM0/INT0 |
| | JP3.3 | JP9.3 | 3 | PB.4/EADC0_CH4/ACMP1_P1/LCD_COM1/I2C0_SDA/SC0_DAT/UART2_RXD/TM1/INT1 |
| | JP3.4 | JP9.4 | 4 | PB.3/EADC0_CH3/ACMP0_N/LCD_COM2/UART1_TXD/SC0_RST/TM2/INT2 |
| | JP3.5 | JP9.5 | 5 | PB.2/EADC0_CH2/ACMP0_P1/LCD_COM3/UART1_RXD/SC0_PWR/TM3/INT3 |
| | JP3.6 | JP9.6 | 6 | PB.1/EADC0_CH1/LCD_SEG1/UART2_TXD |
| | JP3.7 | JP9.7 | 7 | PB.0/EADC0_CH0/LCD_SEG0/UART2_RXD/SPI0_I2SMCLK |
| | JP3.8 | JP9.8 | 8 | PA.11/ACMP0_P0/USCI0_CLK/BPWM0_CH0/TM0_EXT |
| | JP3.9 | JP9.9 | 9 | PA.10/ACMP1_P0/USCI0_DAT0/BPWM0_CH1/TM1_EXT |
| | JP3.10 | JP9.10 | 10 | PA.9/USCI0_DAT1/UART1_TXD/BPWM0_CH2/TM2_EXT |
| | JP3.11 | JP9.11 | 11 | PA.8/USCI0_CTL1/UART1_RXD/BPWM0_CH3/TM3_EXT/INT4 |
| | JP3.12 | JP9.12 | 12 | V _{LCD} |
| | JP3.13 | JP9.13 | 13 | PF.14/CLKO/TM3/INT5 |
| | JP3.14 | JP9.14 | 14 | PF.5/UART2_RXD/UART2_nCTS/BPWM0_CH4/X32_IN/EADC0_ST |
| | JP3.15 | JP9.15 | 15 | PF.4/UART2_TXD/UART2_nRTS/BPWM0_CH5/X32_OUT |
| | JP3.16 | JP9.16 | 16 | PF.3/UART0_TXD/I2C0_SCL/XT1_IN |
| JP5 JP10 | JP5.1 | JP10.1 | 17 | PF.2/UART0_RXD/I2C0_SDA/XT1_OUT |
| | JP5.2 | JP10.2 | 18 | PC.7/LCD_SEG39/UART0_nCTS/TM0/INT3 |
| | JP5.3 | JP10.3 | 19 | PC.6/LCD_SEG38/UART0_nRTS/TM1/INT2 |
| | JP5.4 | JP10.4 | 20 | PA.7/LCD_SEG37/UART0_TXD/ACMP0_WLAT/TM2/INT1 |
| | JP5.5 | JP10.5 | 21 | PA.6/LCD_SEG36/UART0_RXD/ACMP1_WLAT/TM3/INT0 |
| | JP5.6 | JP10.6 | 22 | V _{SS} |
| | JP5.7 | JP10.7 | 23 | V _{DB} |
| | JP5.8 | JP10.8 | 24 | PD.15/TK_TK0/TM3/INT1 |
| | JP5.9 | JP10.9 | 25 | PA.5/TK_TK1/UART0_nCTS/UART0_TXD/I2C0_SCL/BPWM0_CH5 |
| | JP5.10 | JP10.10 | 26 | PA.4/SPI0_I2SMCLK/TK_TK2/SC0_nCD/UART0_nRTS/UART0_RXD/I2C0_SDA/BPWM0_CH4 |
| | JP5.11 | JP10.11 | 27 | PA.3/SPI0_SS/TK_TK3/SC0_PWR/I2C0_SMBAL/UART1_TXD/BPWM0_CH3/CLKO |
| | JP5.12 | JP10.12 | 28 | PA.2/SPI0_CLK/TK_TK4/SC0_RST/I2C0_SMBUS/UART1_RXD/BPWM0_CH2 |
| | JP5.13 | JP10.13 | 29 | PA.1/SPI0_MISO/TK_TK5/SC0_DAT/UART0_TXD/UART1_nCTS/BPWM0_CH1 |
| | JP5.14 | JP10.14 | 30 | PA.0/SPI0_MOSI/TK_TK6/SC0_CLK/UART0_RXD/UART1_nRTS/BPWM0_CH0 |
| | JP5.15 | JP10.15 | 31 | PF.15/LCD_SEG35/TK_TK7/TM2/CLKO/INT4 |
| | JP5.16 | JP10.16 | 32 | nRESET |
| JP4 JP7 | JP4.1 | JP7.1 | 33 | PF.0/UART1_TXD/UART0_TXD/ICE_DAT |
| | JP4.2 | JP7.2 | 34 | PF.1/UART1_RXD/UART0_RXD/ICE_CLK |

| Header | | | M256SD2AE | | |
|---|------------|-------|---|-----------------|--|
| | | | Pin No. | Function | |
| JP4.3 JP4.4 JP4.5 JP4.6 JP4.7 JP4.8 JP4.9 JP4.10 JP4.11 JP4.12 JP4.13 JP4.14 JP4.15 JP4.16 | JP7.3 | 35 | PC.5/LCD_SEG31/LCD_COM4/TK_TK9/UART2_TXD | | |
| | JP7.4 | 36 | PC.4/LCD_SEG30/LCD_COM5/TK_TK10/UART2_RXD | | |
| | JP7.5 | 37 | PC.3/LCD_SEG29/LCD_COM6/TK_TK11/UART2_nRTS/I2C0_SMBAL | | |
| | JP7.6 | 38 | PC.2/LCD_SEG28/LCD_COM7/TK_TK12/UART2_nCTS/I2C0_SMBSUS | | |
| | JP7.7 | 39 | PC.1/LCD_SEG27/LCD_COM2/UART2_TXD/I2C0_SCL/ACMP0_O | | |
| | JP7.8 | 40 | PC.0/LCD_SEG26/LCD_COM3/UART2_RXD/I2C0_SDA/ACMP1_O | | |
| | JP7.9 | 41 | PD.3/USCI0_CTL1/SPI0_SS/LCD_SEG25/TK_TK13/UART0_TXD | | |
| | JP7.10 | 42 | PD.2/USCI0_DAT1/SPI0_CLK/LCD_SEG24/TK_TK14/UART0_RXD | | |
| | JP7.11 | 43 | PD.1/USCI0_DAT0/SPI0_MISO/LCD_SEG23/TK_TK15 | | |
| | JP7.12 | 44 | PD.0/USCI0_CLK/SPI0_MOSI/LCD_SEG22/TK_TK16/TM2 | | |
| | JP7.13 | 45 | PA.12/LCD_SEG20/LCD_SEG47 | | |
| | JP7.14 | 46 | PA.13/LCD_SEG19/LCD_SEG46 | | |
| | JP7.15 | 47 | PA.14/UART0_TXD/LCD_SEG18/LCD_SEG45 | | |
| | JP7.16 | 48 | PA.15/UART0_RXD/LCD_SEG17/LCD_SEG44 | | |
| | JP6 JP8 | JP8.1 | 49 | V _{SS} | |
| | | JP8.2 | 50 | LDO_CAP | |
| JP8.3 | | 51 | V _{DD} | | |
| JP8.4 | | 52 | PC.14/SPI0_I2SMCLK/USCI0_CTL0/LCD_SEG14/LCD_COM0/TM1 | | |
| JP8.5 | | 53 | PB.15/EADC0_CH15/SPI0_SS/USCI0_CTL1/UART0_nCTS/LCD_SEG13/LCD_COM1/TM0_EXT | | |
| JP8.6 | | 54 | PB.14/EADC0_CH14/SPI0_CLK/USCI0_DAT1/UART0_nRTS/LCD_SEG12/TM1_EXT/CLK_O/TK_SE | | |
| JP8.7 | | 55 | PB.13/EADC0_CH13/ACMP0_P3/ACMP1_P3/SPI0_MISO/USCI0_DAT0/UART0_TXD/LCD_SEG11/TM2_EXT | | |
| JP8.8 | | 56 | PB.12/EADC0_CH12/ACMP0_P2/ACMP1_P2/SPI0_MOSI/USCI0_CLK/UART0_RXD/LCD_SEG10/TM3_EXT | | |
| JP8.9 | | 57 | AV _{DD} | | |
| JP8.10 | | 58 | V _{REF} | | |
| JP8.11 | | 59 | AV _{SS} | | |
| JP8.12 | | 60 | PB.11/EADC0_CH11/UART0_nCTS/LCD_SEG9/SPI0_I2SMCLK | | |
| JP8.13 | | 61 | PB.10/EADC0_CH10/UART0_nRTS/LCD_SEG8/LCD_V1 | | |
| JP8.14 | | 62 | PB.9/EADC0_CH9/UART0_TXD/UART1_nCTS/LCD_SEG7/LCD_V2 | | |
| JP8.15 | | 63 | PB.8/EADC0_CH8/UART0_RXD/UART1_nRTS/LCD_SEG6/LCD_V3 | | |
| JP8.16 | | 64 | PB.7/EADC0_CH7/UART1_TXD/LCD_SEG5/INT5/ACMP0_O | | |

Table 3-2 M256SD2AE Full-pin Extension Connectors and GPIO Function List

3.3.2 NuMaker-TNLCDSUB_M256SD Compatible Extension Connectors

Table 3-3 shows the NuMaker-TNLCDSUB_M256SD compatible extension connectors.

| Header | | NuMaker-M256SD | | NuMaker-TNLCDSUB_M256SD |
|--------|--------|----------------|-----------|-------------------------|
| | | Pin No. | Function | Function |
| JP3 | JP3.1 | 1 | LCD_SEG4 | LCD_SEG10 |
| | JP3.2 | 2 | LCD_COM0 | LCD_COM3 |
| | JP3.3 | 3 | LCD_COM1 | LCD_COM2 |
| | JP3.4 | 4 | LCD_COM2 | LCD_COM1 |
| | JP3.5 | 5 | LCD_COM3 | LCD_COM0 |
| | JP3.6 | 6 | LCD_SEG1 | LCD_SEG21 |
| | JP3.7 | 7 | LCD_SEG0 | LCD_SEG20 |
| JP5 | JP5.2 | 18 | LCD_SEG39 | LCD_SEG19 |
| | JP5.3 | 19 | LCD_SEG38 | LCD_SEG18 |
| | JP5.4 | 20 | LCD_SEG37 | LCD_SEG25 |
| | JP5.5 | 21 | LCD_SEG36 | LCD_SEG27 |
| | JP5.15 | 31 | LCD_SEG35 | LCD_SEG15 |
| JP4 | JP4.3 | 35 | LCD_COM4 | LCD_COM7 |
| | JP4.4 | 36 | LCD_COM5 | LCD_COM6 |
| | JP4.5 | 37 | LCD_COM6 | LCD_COM5 |
| | JP4.6 | 38 | LCD_COM7 | LCD_COM4 |
| | JP4.7 | 39 | LCD_SEG27 | LCD_SEG39 |
| | JP4.8 | 40 | LCD_SEG26 | LCD_SEG38 |
| | JP4.9 | 41 | LCD_SEG25 | LCD_SEG37 |
| | JP4.10 | 42 | LCD_SEG24 | LCD_SEG36 |
| | JP4.11 | 43 | LCD_SEG23 | LCD_SEG35 |
| | JP4.12 | 44 | LCD_SEG22 | LCD_SEG34 |
| | JP4.13 | 45 | LCD_SEG20 | LCD_SEG33 |
| | JP4.14 | 46 | LCD_SEG19 | LCD_SEG32 |
| | JP4.15 | 47 | LCD_SEG18 | LCD_SEG31 |
| | JP4.16 | 48 | LCD_SEG17 | LCD_SEG30 |
| JP6 | JP6.4 | 52 | LCD_SEG14 | LCD_SEG29 |

| | | | | |
|--|--------|----|-----------|-----------|
| | JP6.5 | 53 | LCD_SEG13 | LCD_SEG28 |
| | JP6.6 | 54 | LCD_SEG12 | LCD_SEG16 |
| | JP6.7 | 60 | LCD_SEG9 | LCD_SEG24 |
| | JP6.8 | 61 | LCD_SEG8 | LCD_SEG23 |
| | JP6.9 | 62 | LCD_SEG7 | LCD_SEG22 |
| | JP6.10 | 63 | LCD_SEG6 | LCD_SEG26 |
| | JP6.11 | 64 | LCD_SEG5 | LCD_SEG17 |

Table 3-3 NuMaker-TNLCDSUB_M256SD Extension Connectors and M256SD2AE Mapping GPIO List

3.3.3 Arduino UNO Compatible Extension Connectors

Figure 3-4 shows the Arduino UNO compatible extension connectors.

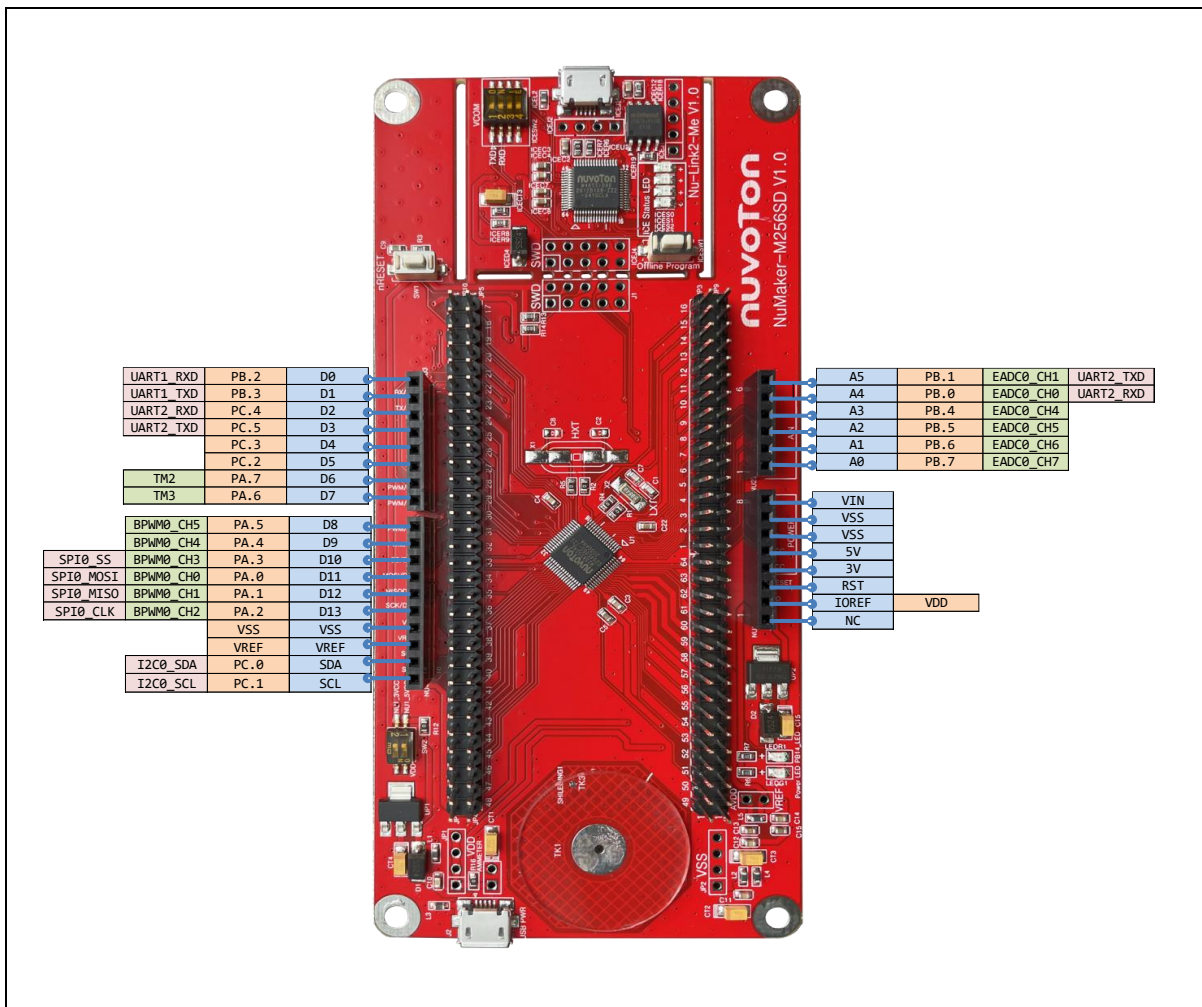


Figure 3-4 Arduino UNO Compatible Extension Connectors

| Header | | NuMaker-M256SD | | Header | | NuMaker-M256SD | |
|--------|--------|---------------------------|------------------|--------|-------|---------------------------|------------------|
| | | Compatible to Arduino UNO | GPIO Pin of M256 | | | Compatible to Arduino UNO | GPIO Pin of M256 |
| NU3 | NU3.1 | D0 | PB.2 | NU2 | NU2.6 | A5 | PB.1 |
| | NU3.2 | D1 | PB.3 | | NU2.5 | A4 | PB.0 |
| | NU3.3 | D2 | PC.4 | | NU2.4 | A3 | PB.4 |
| | NU3.4 | D3 | PC.5 | | NU2.3 | A2 | PB.5 |
| | NU3.5 | D4 | PC.3 | | NU2.2 | A1 | PB.6 |
| | NU3.6 | D5 | PC.2 | | NU2.1 | A0 | PB.7 |
| | NU3.7 | D6 | PA.7 | NU1 | NU1.8 | VIN | - |
| | NU3.8 | D7 | PA.6 | | NU1.7 | VSS | |
| NU4 | NU4.1 | D8 | PA.5 | | NU1.6 | VSS | |
| | NU4.2 | D9 | PA.4 | | NU1.5 | 5V | |
| | NU4.3 | D10 | PA.3 | | NU1.4 | 3V | |
| | NU4.4 | D11 | PA.0 | | NU1.3 | RST | nRESET |
| | NU4.5 | D12 | PA.1 | | NU1.2 | VDD | V _{DD} |
| | NU4.6 | D13 | PA.2 | | NU1.1 | NC | - |
| | NU4.7 | VSS | V _{SS} | | | | |
| | NU4.8 | VREF | V _{REF} | | | | |
| | NU4.9 | SDA | PC.0 | | | | |
| | NU4.10 | SCL | PC.1 | | | | |

Table 3-4 Arduino UNO Extension Connectors and M256SD2AE Mapping GPIO List

3.4 Power Supply Configuration

The NuMaker-M256SD is able to adopt multiple power supplies. External power sources include NU1 Vin (7 V to 12 V), V_{DD} (depending on the target chip operating voltage), and PC through USB connector. By using switches and voltage regulator, multiple power domains can be created on the NuMaker-M256SD.

3.4.1 VIN Power Source

Table 3-5 presents the Vin power source.

| Connector | Net Name in Schematic | Description |
|-----------|-----------------------|---|
| 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 NU1_5VCC. |

Table 3-5 Vin Power Source

3.4.2 5 V Power Sources

Table 3-6 presents the 5 V power sources.

| Connector | Net Name in Schematic | Description |
|-----------|-----------------------|--|
| ICEJ3 | USB_HS_VBUS | ICE USB connector supplies 5 V power from PC to M256SD target board and Nu-Link2-Me. |
| J2 | USB_VBUS | USB connector on NuMaker-M256SD supplies 5 V power from PC to M256SD target board 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 3-6 5 V Power Sources

3.4.3 3.3 V Power Sources

Table 3-7 presents the 3.3 V power sources.

| Voltage Regulator | 5 V Source | Description |
|-------------------|-------------|--|
| ICEUP1 | USB_HS_VBUS | ICEUP1 converts USB_HS_VBUS to 3.3 V and supplies 3.3 V to M256SD target board or ICE chip. |
| UP1 | USB_VBUS | UP1 converts USB_VBUS to 3.3 V and supplies 3.3 V to M256SD target board. Note: 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 M256SD target board. Note: SW2.2 (NU1 3VCC) should be switched to ON. |

Table 3-7 3.3 V Power Sources

3.4.4 1.8 V Power Sources

Table 3-8 presents the 1.8 V power source.

| Voltage Regular | 5V Source | Description |
|-----------------|-------------|---|
| ICEUP2 | USB_HS_VBUS | ICEUP2 converts USB_HS_VBUS to 1.8 V and supplies 1.8 V to M256SD target board or ICE chip. |

Table 3-8 1.8 V Power Sources

3.4.5 Power Connectors

Table 3-9 presents the power connectors.

| Connector | Description |
|-----------|--|
| JP1 | V _{DD} connector on the NuMaker-M256SD. Note: M256 operating voltage range is from 1.75 V to 5.5 V. |
| JP2 | V _{SS} connector on the NuMaker-M256SD. |

Table 3-9 Power Connectors

3.4.6 USB Connectors

Table 3-10 presents the USB connectors.

| Connector | Description |
|-----------|---|
| ICEJ3 | ICE USB connector on Nu-Link2-Me for power supply, debugging and programming from PC. |
| J2 | USB Power connector on NuMaker-M256SD for power supply. |

Table 3-10 USB Connectors

3.4.7 Power Switches

Table 3-11 presents the power switches.

| Switch | Description |
|---------|--|
| 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 3-11 Power Switches

3.4.8 Power Supply Models

3.4.8.1 External Power Supply through Nu-Link2-Me to Target Chip

The external power supply source on Nu-Link2-Me is shown in Figure 3-5.

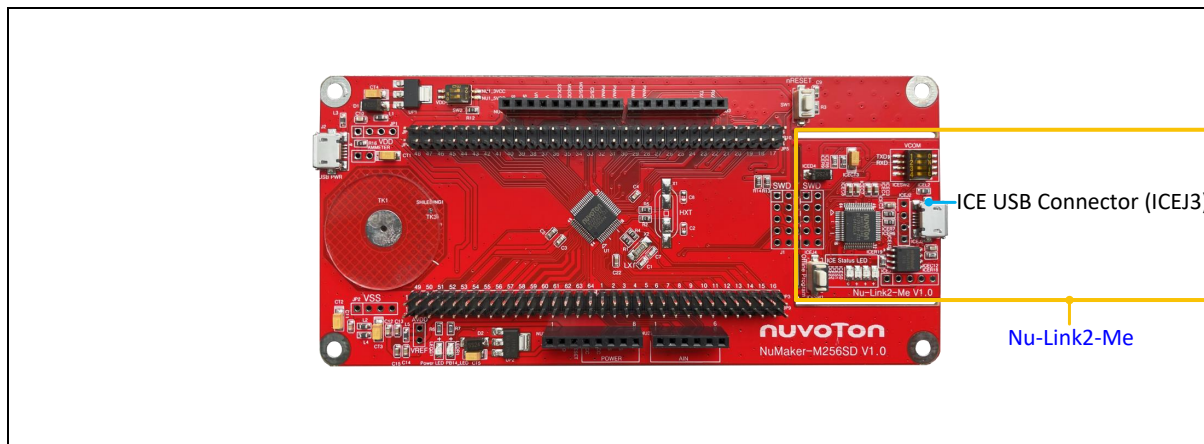


Figure 3-5 External Power Supply Sources on Nu-Link2-Me

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

1. Solder the resistor on ICEJPR1 (MCUVCC) depending on the target chip operating voltage.

2. Solder the resistor on ICEJPR2 (ICEVCC) depending on the ICE chip operating voltage.
3. Switch the SW2 to OFF.
4. Connect the external power supply to ICEJ3.

Table 3-12 presents all power models when supplying 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 [1] | ICEJPR2 (ICEVCC) Selection [2] | 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 | - | - | 1.8 V output |
| 2 | 3.3 V | Connect to PC | 3.3 V (default) | 3.3 V (default) | 3.3 V | Off | - | - | 3.3 V output |
| 3 | 5 V | Connect to PC | 5 V | 3.3 V (default) | 3.3 V | Off | - | - | 5 V output |

Note:

1. 0 Ω should be soldered between ICEJPR1's MCUVCC and 1.8 V / 3.3 V / 5 V.
2. 0 Ω should be soldered between ICEJPR2's ICEVCC and 1.8 V / 3.3 V.
3. -: Unused.

Table 3-12 Supply External Power through Nu-Link2-Me

3.4.8.2 External Power Supply through M256SD Target Board to Target Chip

The external power supply sources on M256SD target board are shown in Figure 3-6.

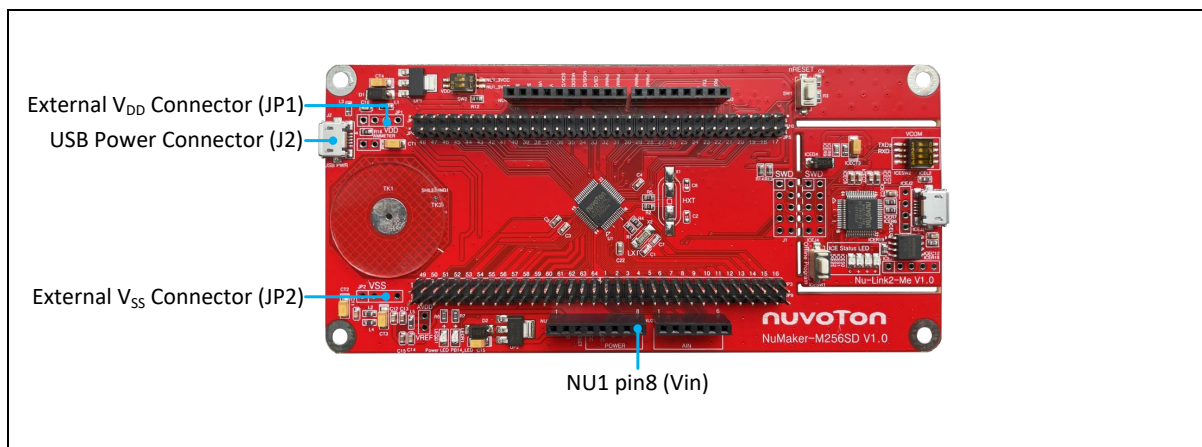


Figure 3-6 External Power Supply Sources on M256SD Target Board

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

1. Switch the SW2 depending on the target chip operating voltage.
2. Remove the resistor on ICEJPR1 (MCUVCC).
3. Solder the resistor on ICEJPR2 (ICEVCC) depending 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 steps below:

1. Switch the SW2 to OFF.

2. Remove the resistor on ICEJPR1 (MCUVCC).
3. Solder the resistor on ICEJPR2 (ICEVCC) depending 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 detached from NuMaker-M256SD, please follow the steps below:

1. Switch the SW2 depending on the target chip operating voltage.
2. Detach the Nu-Link2-Me from NuMaker-M256SD.
3. Connect the external power supply to Vin or J2.

To use JP1 as external power supply source with Nu-Link2-Me detached from NuMaker-M256SD, please follow the steps below:

1. Switch the SW2 to OFF.
2. Detach the Nu-Link2-Me from NuMaker-M256SD.
3. Connect the external power supply to JP1.

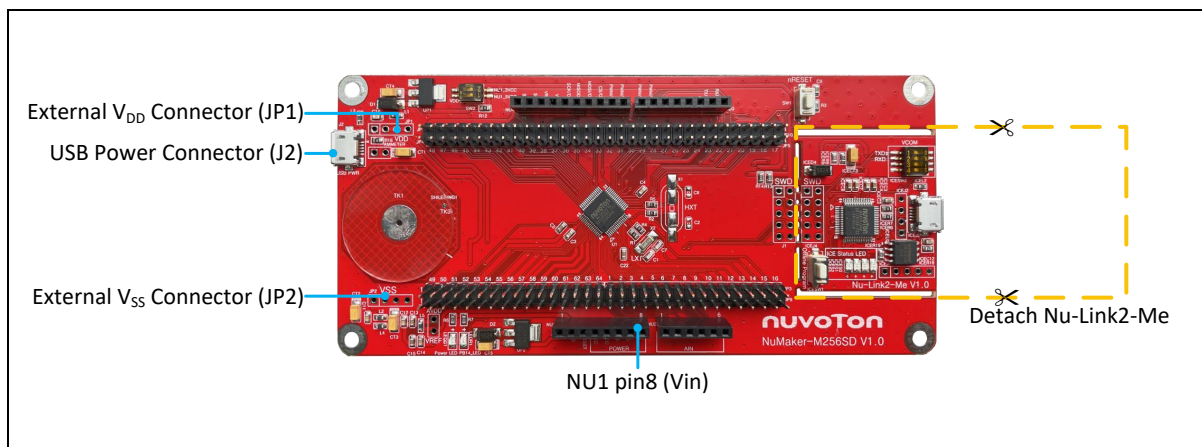


Figure 3-7 Detach the Nu-Link2-Me from NuMaker-M256SD

Table 3-13 presents all power models when supplies external power through M256SD target board. The M256SD target board external power sources are highlighted in yellow.

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

Note:

1. The Vin input voltage will be converted by voltage regulator UP2 to 5 V. Supplying external power to Vin or J2 can provide 5 V to NU1 pin5 (5V) and 3.3 V to NU1 pin4 (3VCC).
2. JP1 external power input only provides voltage to target chip.
3. 0 Ω should be removed from ICEJPR1's MCVCC and 1.8 V / 3.3 V / 5 V.
4. 0 Ω should be soldered between ICEJPR2's ICEVCC and 1.8 V / 3.3 V.
5. The ICE chip voltage should be close to the target chip voltage.
6. -: Unused

Table 3-13 Supply External Power for M256SD Target Board

3.5 External Reference Voltage Connector

Table 3-14 presents the external reference voltage connector.

| Connector | Description |
|-----------|---|
| VREF1 | Connector for user to connect to the external reference voltage pin of the target chip. User needs to remove the L5 ferrite bead. |

Table 3-14 External Reference Voltage Connector

3.6 Ammeter Connector

Table 3-15 presents the ammeter connector.

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

Table 3-15 Ammeter Connector

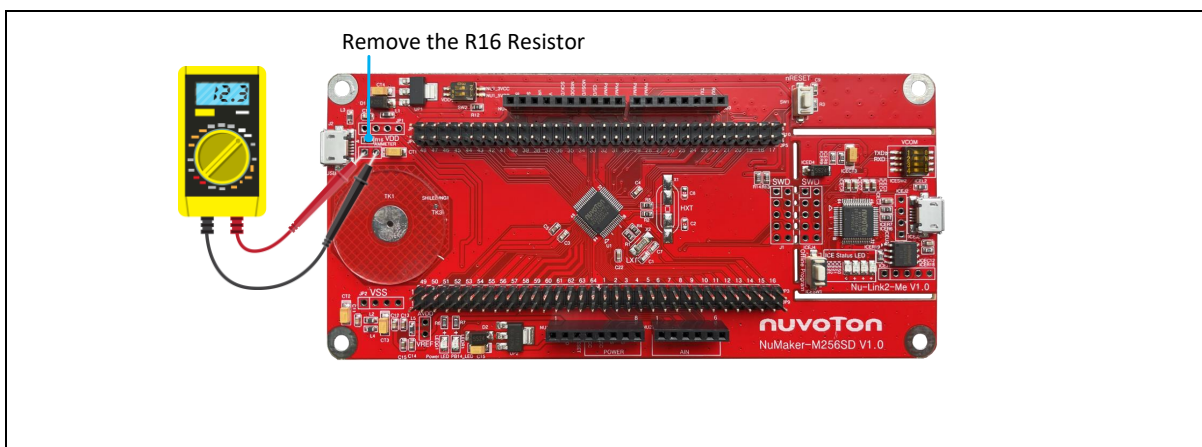


Figure 3-8 Wiring between Ammeter Connector and Ammeter

3.7 Touch Key

Table 3-16 presents the touch key, shielding electrode and reference pad.

| Connector | Description |
|-----------|----------------------|
| TK1 | Touch key. |
| TK3 | Shielding electrode. |
| TK0 | Reference pad. |

Table 3-16 Touch Key

3.8 Push Buttons

Table 3-17 presents the push buttons.

| Component | Description |
|-----------|--|
| ICESW1 | Offline program button to start offline ICP programming the target chip. |
| SW1 | Reset button to reset the target chip. |

Table 3-17 Push Buttons

3.9 LEDs

Table 3-18 presents the LEDs.

| Component | Description |
|-------------------------------|---|
| Power LED | The power LED indicates that the NuMaker-M256SD is powered. |
| PB14 LED | The LED is connected to the target chip PB.14. |
| ICES0, ICES1, ICES2 and ICES3 | Nu-Link2-Me status LED. |

Table 3-18 LEDs

3.10 LCD Panel

The LCD on the NuMaker-M256SD with 8 x 26 COM/SEG can be used to show some information such as time, battery status, temperature, and humidity. The part number of LCD panel is RHE6616TP01 made by TRICOMTEK. Figure 3-9 shows the LCD digit segment mapping table. Table 3-20 shows the pin map for the LCD.

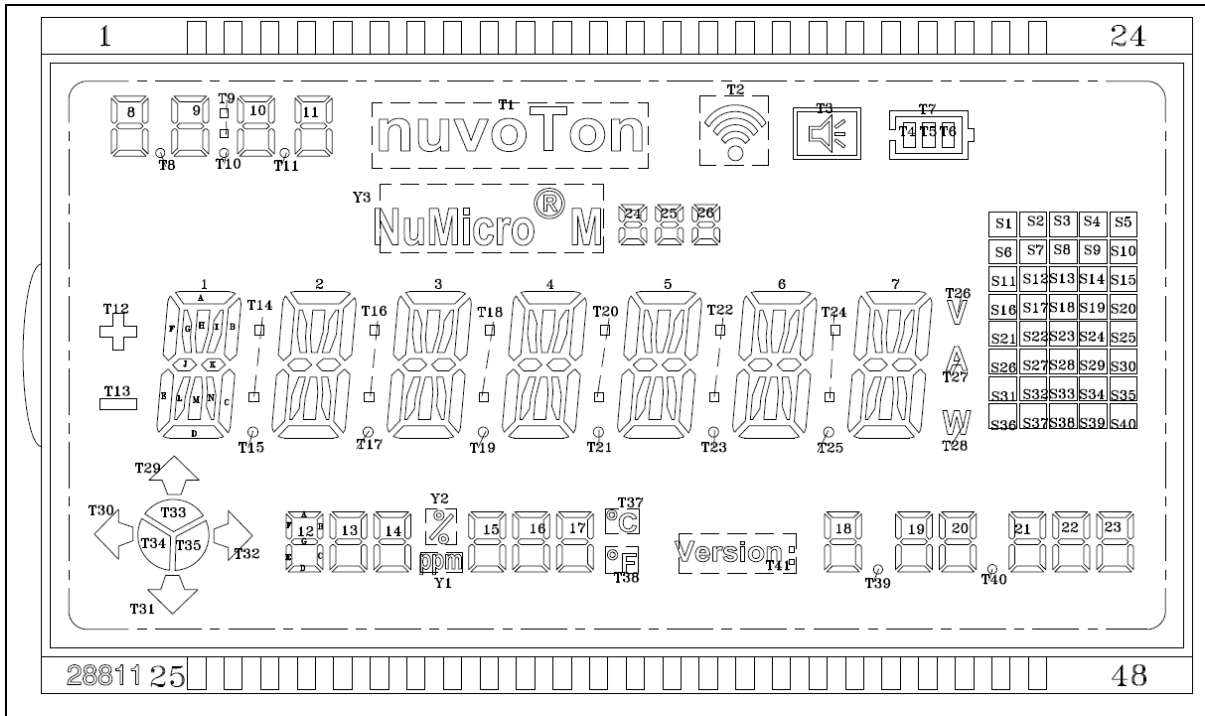


Figure 3-9 LCD Digit Segment Mapping

Table 3-19 presents LCD specifications.

| Parameter | Specifications |
|-------------------|------------------------------------|
| Drive Condition | 1/8 Duty, 1/4 Bias, 8 x 40 COM/SEG |
| View Direction | 12 O'Clock |
| Operating Voltage | 4.8 V |
| Dimension | 100 ± 0.2 mm x 64 ± 0.2 mm |
| Connectors | PIN |

Table 3-19 LCD Specifications

| PIN | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|------|----|----|----|-----|-----|-----|-----|-----|-----|----|-----|
| COM1 | 1B | 1A | 1G | 1F | 24C | 25D | 25C | 26D | 26C | T7 | S1 |
| COM2 | 1I | 1H | 1J | T12 | 24G | 25E | 25G | 26E | 26G | T6 | S6 |
| COM3 | 1K | 1N | 1M | 1E | 24B | 25F | 25B | 26F | 26B | T4 | S11 |

| | | | | | | | | | | | |
|------|-----|-----|-----|------|------|------|------|------|------|------|------|
| COM4 | 1C | 1D | 1L | T13 | T10 | 25A | T11 | 26A | Y3 | T5 | S16 |
| COM5 | T32 | T29 | 8D | 8C | 9C | 10D | 10C | 11D | 11C | T1 | S21 |
| COM6 | T35 | T33 | 8E | 8G | 9G | 10E | 10G | 11E | 11G | T2 | S26 |
| COM7 | T34 | T30 | 8F | 8B | 9B | 10F | 10B | 11F | 11B | T3 | S31 |
| COM8 | T31 | - | 8A | T8 | T9 | 10A | 10A | 11A | - | - | S36 |
| PIN | 13 | 14 | 15 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| COM1 | S2 | S3 | S4 | COM1 | - | - | - | - | - | - | - |
| COM2 | S7 | S8 | S9 | - | COM2 | - | - | - | - | - | - |
| COM3 | S12 | S13 | S14 | - | - | COM3 | - | - | - | - | - |
| COM4 | S17 | S18 | S19 | - | - | - | COM4 | - | - | - | - |
| COM5 | S22 | S23 | S24 | - | - | - | - | COM5 | - | - | - |
| COM6 | S27 | S28 | S29 | - | - | - | - | - | COM6 | - | - |
| COM7 | S32 | S33 | S34 | - | - | - | - | - | - | COM7 | - |
| COM8 | S37 | S38 | S39 | - | - | - | - | - | - | - | COM8 |
| PIN | 25 | 26 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| COM1 | 2F | 2G | 2B | 3F | 3G | 3A | 3B | 4F | 4G | 4A | 4B |
| COM2 | T14 | 2J | 2I | T16 | 3J | 3H | 3I | T18 | 4J | 4H | 4I |
| COM3 | 2E | 2M | 2K | 3E | 3M | 3N | 3K | 4E | 4M | 4N | 4K |
| COM4 | T15 | 2L | 2C | T17 | 3L | 3D | 3C | T19 | 4L | 4D | 4C |
| COM5 | 12A | - | - | 14A | Y1 | 15A | Y2 | 16A | T37 | 17A | T38 |
| COM6 | 12F | 12B | 13B | 14F | 14B | 15F | 15B | 16F | 16B | 17F | 17B |
| COM7 | 12E | 12G | 13G | 14E | 14G | 15E | 15G | 16E | 16G | 17E | 17G |
| COM8 | 12D | 12C | 13C | 14D | 14C | 15D | 15C | 16D | 16C | 17D | 17C |
| PIN | 37 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| COM1 | 5F | 5A | 5B | 6F | 6G | 6A | 6B | 7F | 7G | 7A | 7B |
| COM2 | T20 | 5H | 5I | T22 | 6J | 6H | 6I | T24 | 7J | 7H | 7I |
| COM3 | 5E | 5N | 5K | 6E | 6M | 6N | 6K | 7E | 7M | 7N | 7K |
| COM4 | T21 | 5D | 5C | T23 | 6L | 6D | 6C | T25 | 7L | 7D | 7C |
| COM5 | 18A | 19A | T41 | 20A | T40 | 21A | T28 | 22A | T27 | 23A | T26 |
| COM6 | 18F | 19F | 19B | 20F | 20B | 21F | 21B | 22F | 22B | 23F | 23B |
| COM7 | 18E | 19E | 19G | 20E | 20G | 21E | 21G | 22E | 22G | 23E | 23G |
| COM8 | 18D | 19D | 19C | 20D | 20C | 21D | 21C | 22D | 22C | 23D | 23C |

Table 3-20 LCD Pin Mapping Table

3.11 Nu-Link2-Me

The Nu-Link2-Me is an attached on-board debugger and programmer. The Nu-Link2-Me supports on-chip debugging, online and offline ICP programming through SWD interface. The Nu-Link2-Me also supports virtual COM port (VCOM) for printing debug messages on PC. Besides, the programming status could be shown on the built-in LEDs. Lastly, the Nu-Link2-Me could be detached from the evaluation board and become a stand-alone mass production programmer. For more information about Nu-Link2-Me, please refer to *Nu-Link2-Pro Debugger and Programmer User Manual*.

3.11.1 VCOM Switches

Table 3-21 presents how to set the VCOM function by ICESW2.

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

Table 3-21 VCOM Function of Nu-Link2-Me

3.11.2 Status LEDs

Table 3-22 presents the status LEDs patterns for different operation on Nu-Link2-Me.

| Operation Status | Status LED | | | |
|--|------------|-----------|-----------|-----------|
| | ICES0 | ICES1 | ICES2 | ICES3 |
| Boot | Flash x 3 | Flash x 3 | Flash x 3 | Flash x 3 |
| Idle | On | - | - | - |
| One Nu-Link2-Me is selected to connect | Flash x 3 | Flash x 3 | Flash x 3 | On |
| ICE online (Not connected to a target chip) | On | - | Flash x 3 | Flash x 3 |
| ICE online (Connected to a target chip) | On | - | - | On |
| ICE online (Failed to connect to a target chip) | On | Any | Flash | On |
| During offline programming | - | On | - | Flash |
| Offline programming completed | On | - | - | - |
| Offline programming completed (Auto mode) | On | On | - | - |
| Offline programming failed | On | Flash | - | - |
| Note: "Online" means Nu-Link2-Me is connected to ICP Programming Tool, IDE or NuTool. | | | | |

Table 3-22 Operation Status LED Patterns

4 QUICK START

4.1 Toolchains Supporting

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

- [KEIL MDK Nuvoton edition M0/M23](#)
- [IAR EWARM](#)
- [NuEclipse GCC \(for Windows\)](#)
- [NuEclipse GCC \(for Linux\)](#)

4.2 Nuvoton Nu-Link Driver Installation

Download and install the latest Nuvoton Nu-Link Driver.

- Download and install [Nu-Link Keil Driver](#) when using Keil MDK.
- Download and install [Nu-Link IAR Driver](#) when using IAR EWARM.
- Skip this step when using NuEclipse.

Please install the Nu-Link USB Driver as well at the end of the installation. The installation is presented in Figure 4-1 and Figure 4-2.

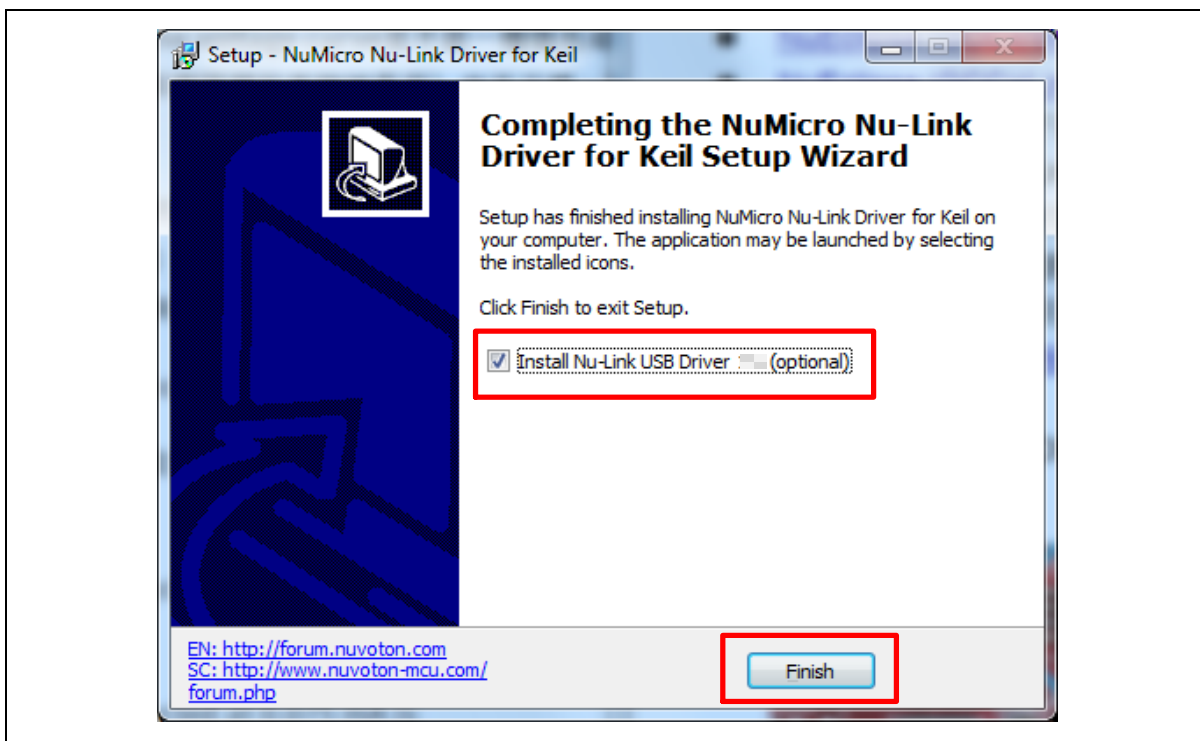


Figure 4-1 Nu-Link USB Driver Installation Setup

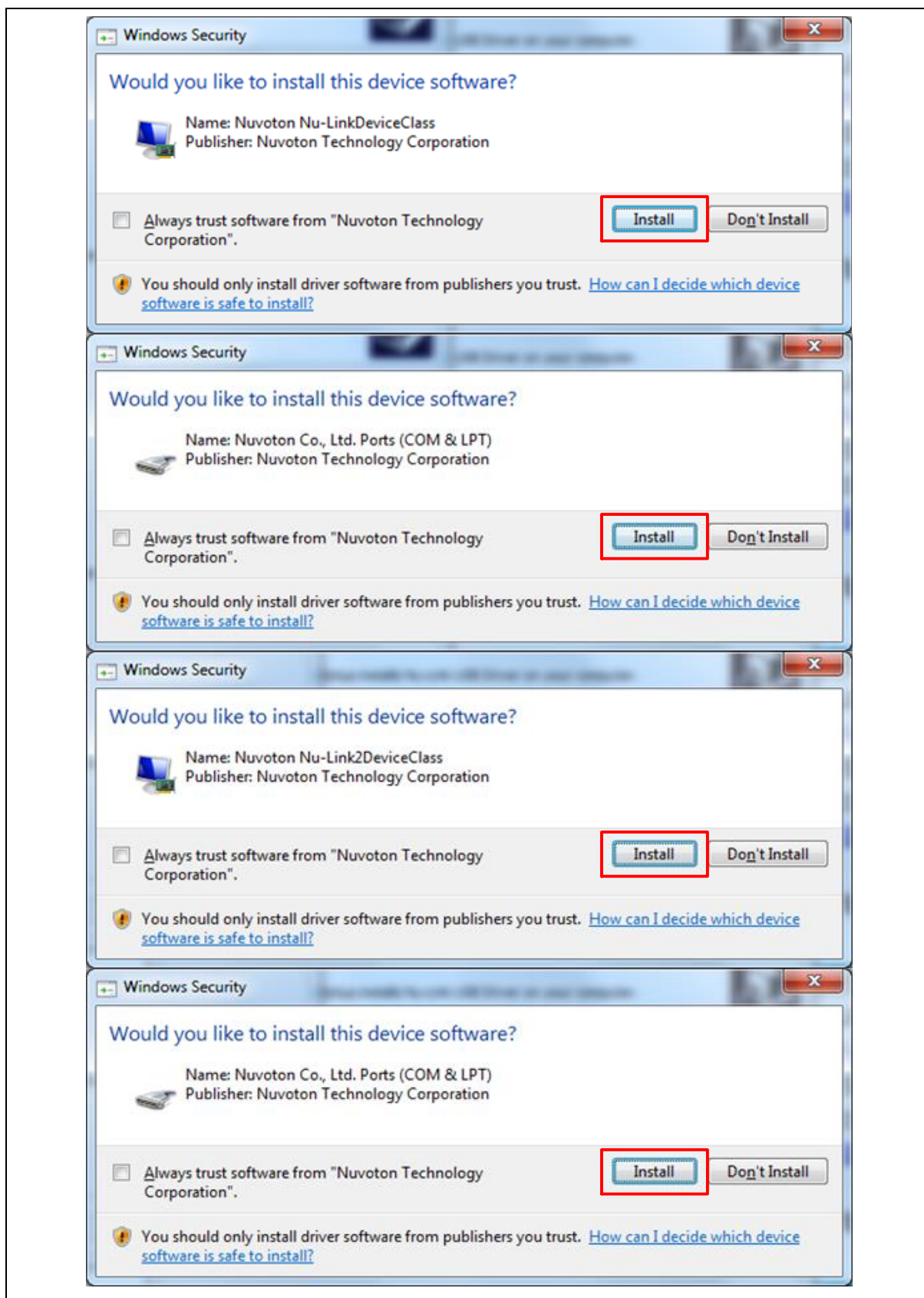


Figure 4-2 Nu-Link USB Driver Installation

4.3 BSP Firmware Download

Download and unzip the [Board Support Package \(BSP\)](#).

4.4 Hardware Setup

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

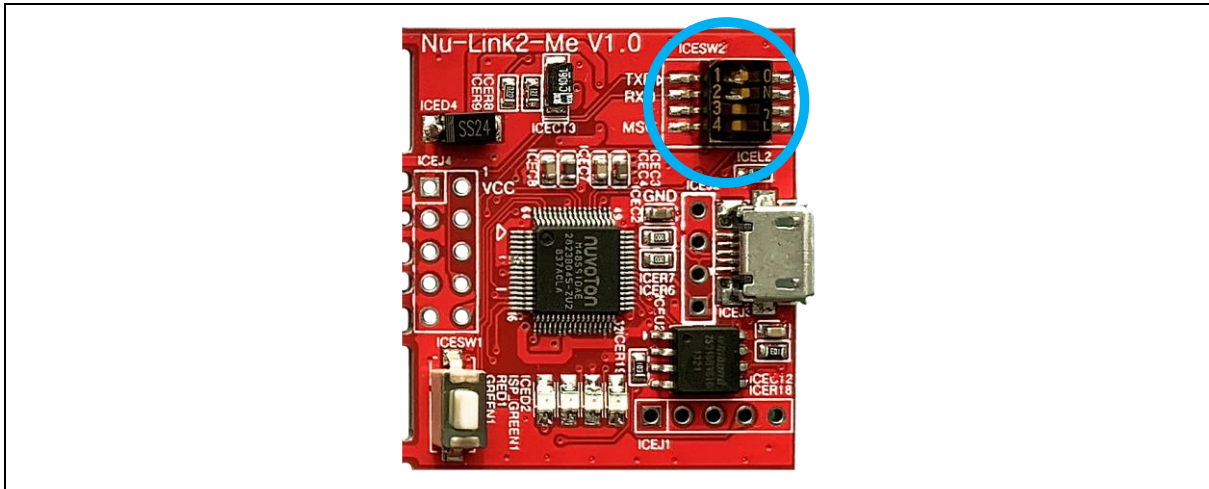


Figure 4-3 Open VCOM Function

2. Connect the ICE USB connector shown in Figure 4-4 to the PC USB port through a USB cable.

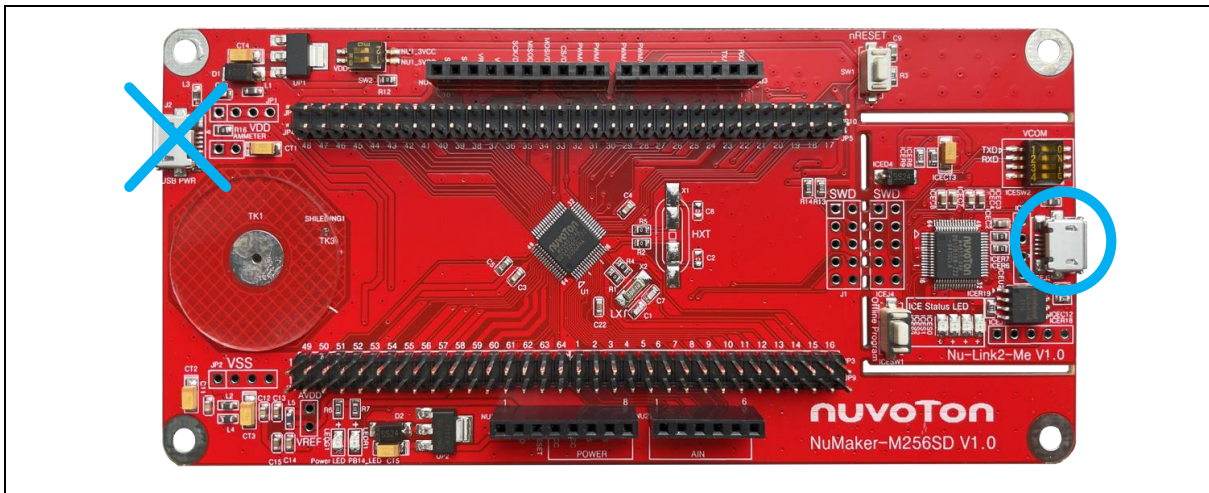


Figure 4-4 ICE USB Connector

3. Find the “Nuvoton Virtual COM Port” on the Device Manger as Figure 4-5.

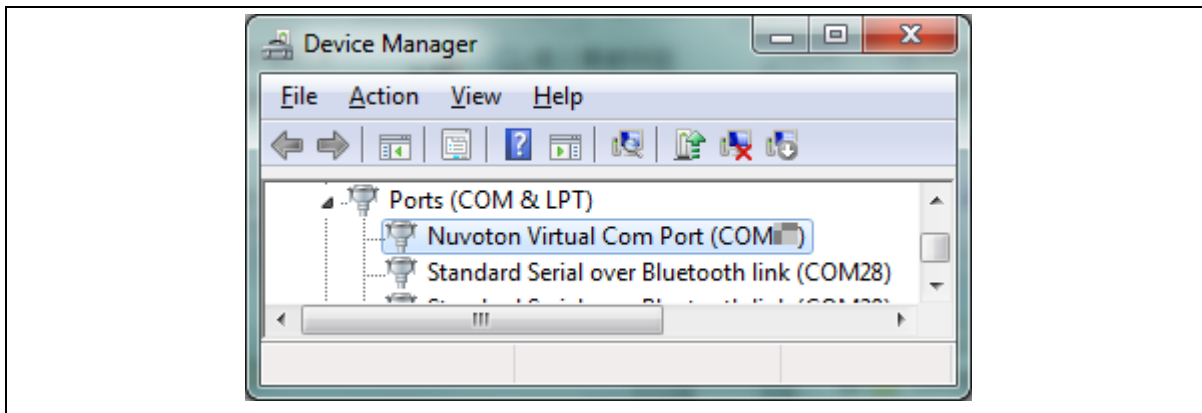


Figure 4-5 Device Manger

4. Open a serial port terminal, PuTTY for example, to print out debug message. Set the speed to 115200. Figure 4-6 presents the PuTTY session setting.

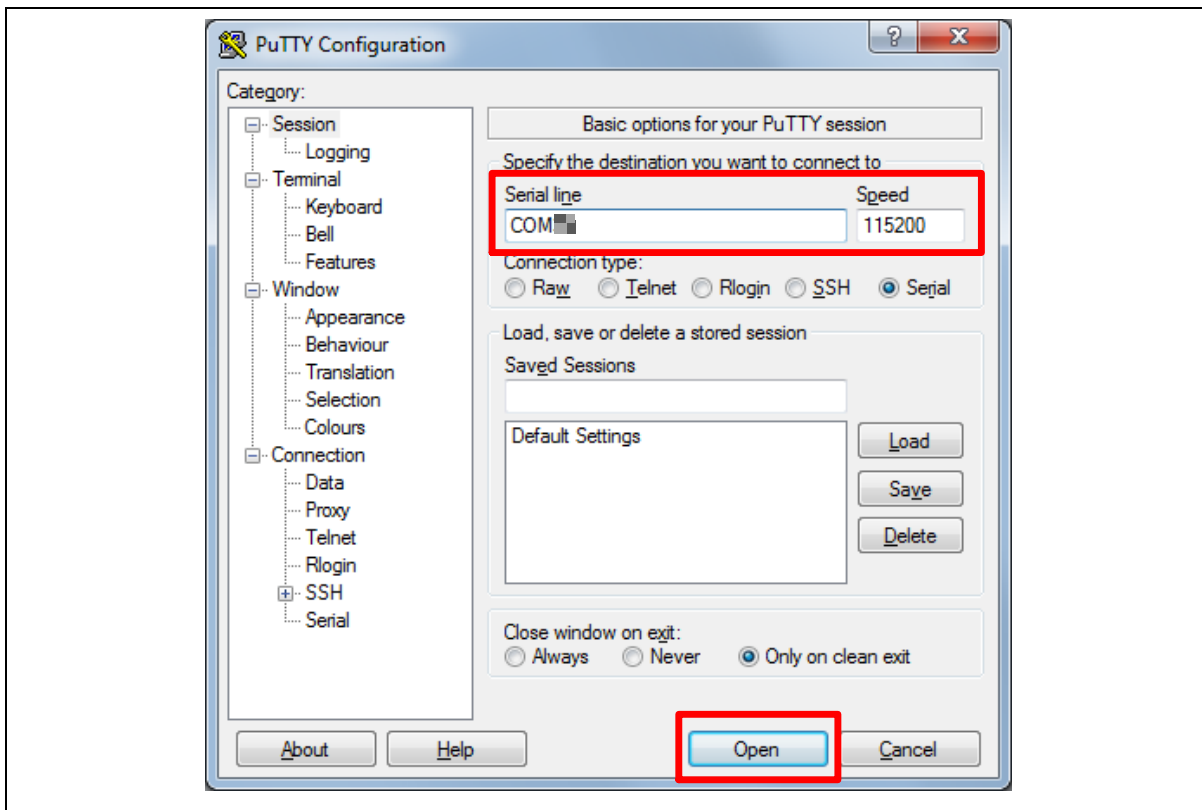


Figure 4-6 PuTTY Session Setting

4.5 Find the Example Project

Use the “Template” project as an example. The project can be found under the BSP folder as shown in Figure 4-7.

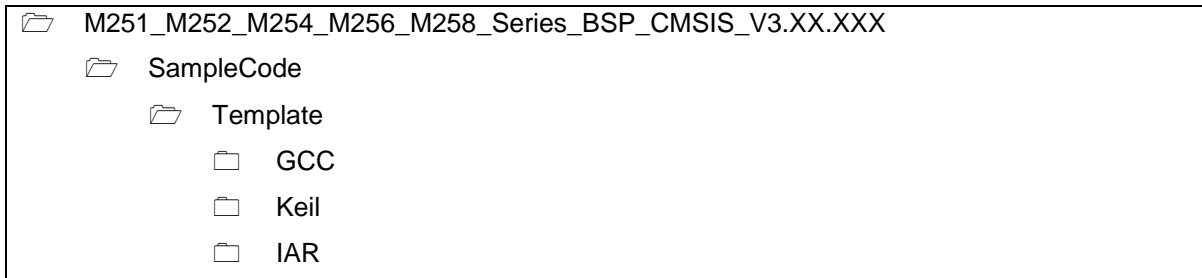


Figure 4-7 Template Project Folder Path

4.6 Execute the Project under Toolchains

Open and execute the project under the toolchain. The section 4.6.1, 4.6.2, and 4.6.3 describe the steps of executing project in Keil MDK, IAR EWARM and NuEclipse, respectively.

4.6.1 Keil MDK

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

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

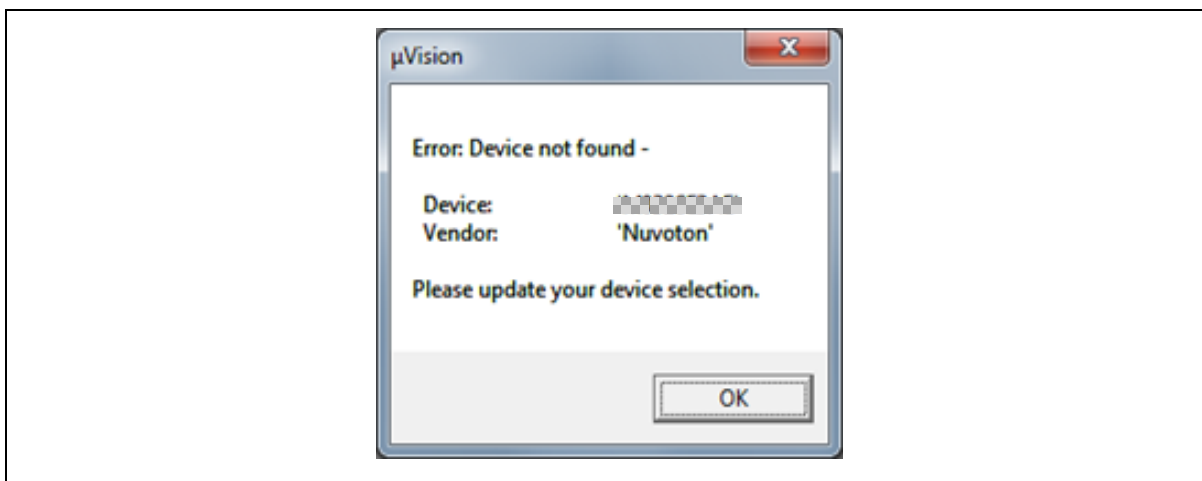


Figure 4-8 Warning Message of “Device not found”

Note: If Figure 4-8 warning message jumps out, please migrate to version 5 format as shown in Figure 4-9. The “.uvproj” filename extension will change to “.uvprojx”.

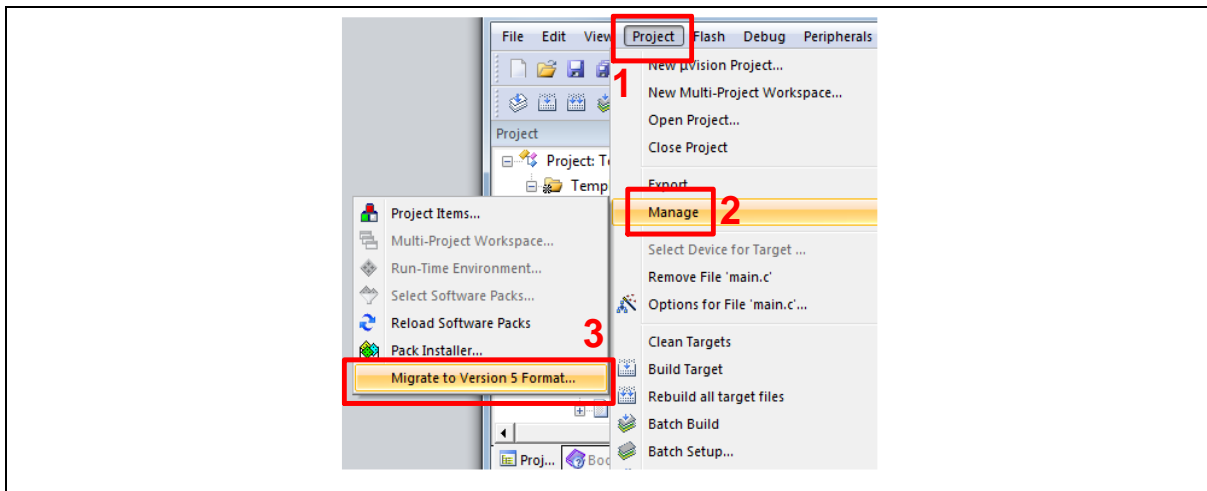


Figure 4-9 Project File Migrate to Version 5 Format

2. Make sure the debugger is “Nuvoton Nu-Link Debugger” as shown in Figure 4-10 and Figure 4-11.

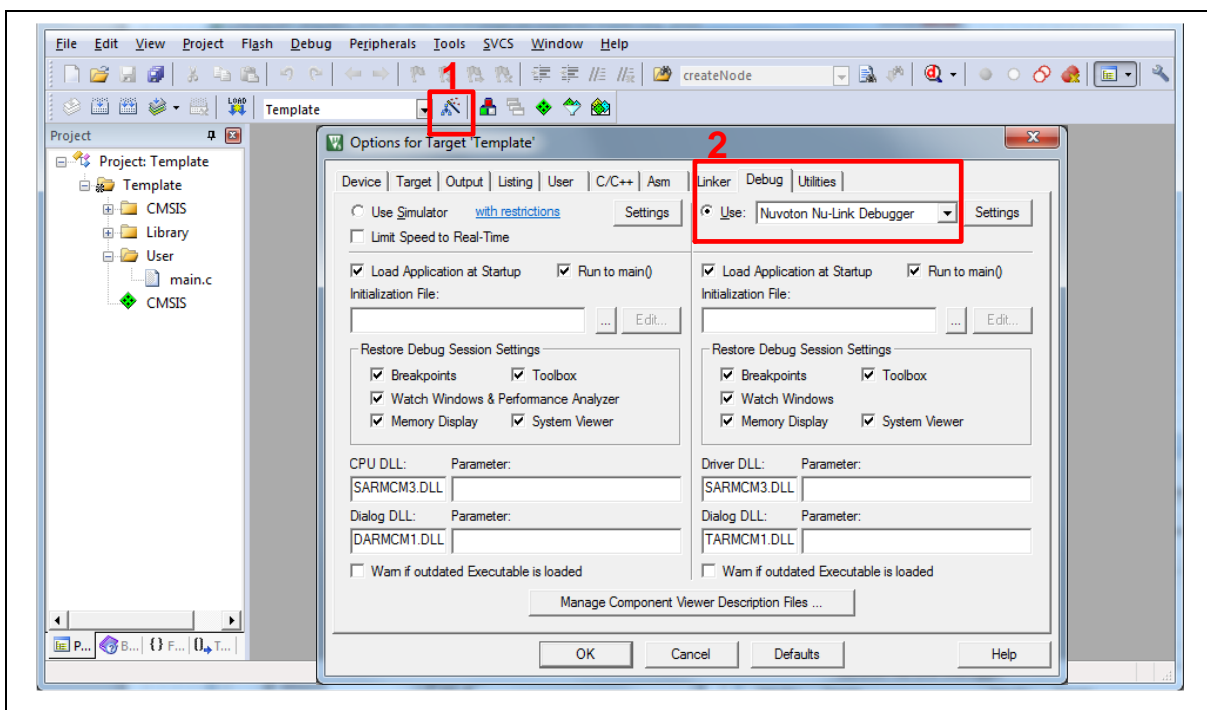


Figure 4-10 Debugger Setting in Options Window

Note: If the dropdown menu in Figure 4-10 does not contain “Nuvoton Nu-Link Debugger” item, please rework section 4.2.

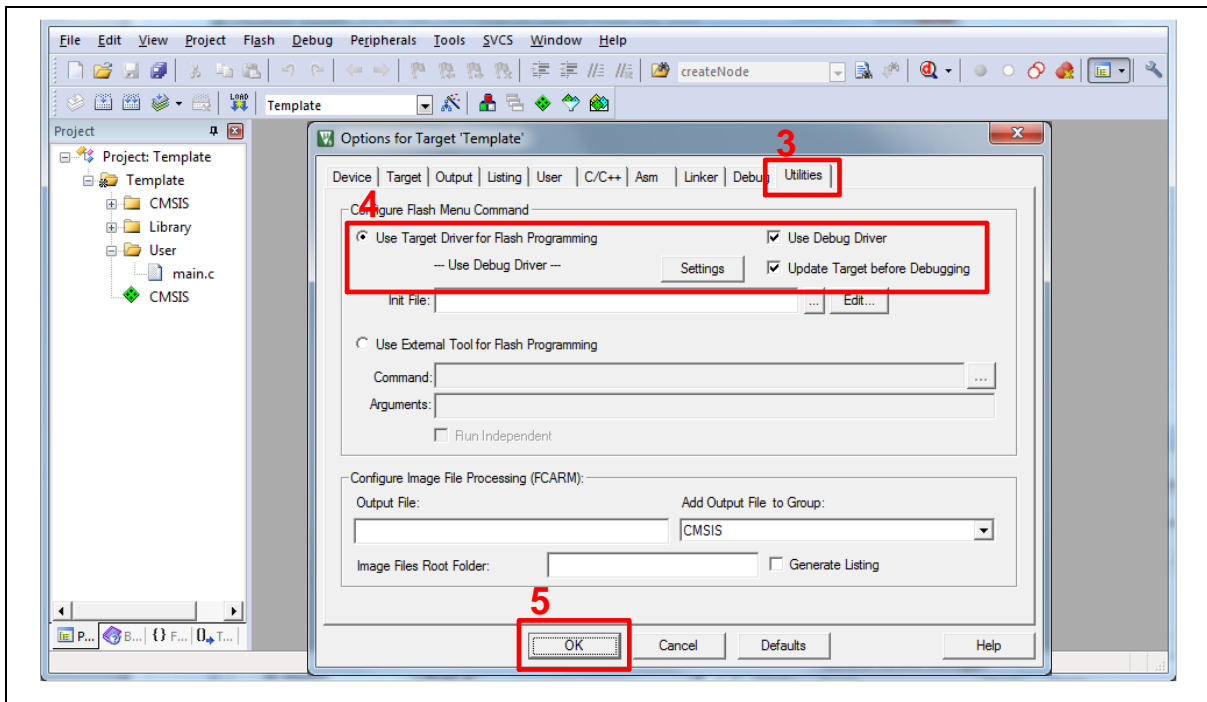


Figure 4-11 Programming Setting in Options Window

3. Rebuild all target files. After successfully compiling the project, download code to the Flash memory. Click **“Start/Stop Debug Section”** button to enter debug mode.

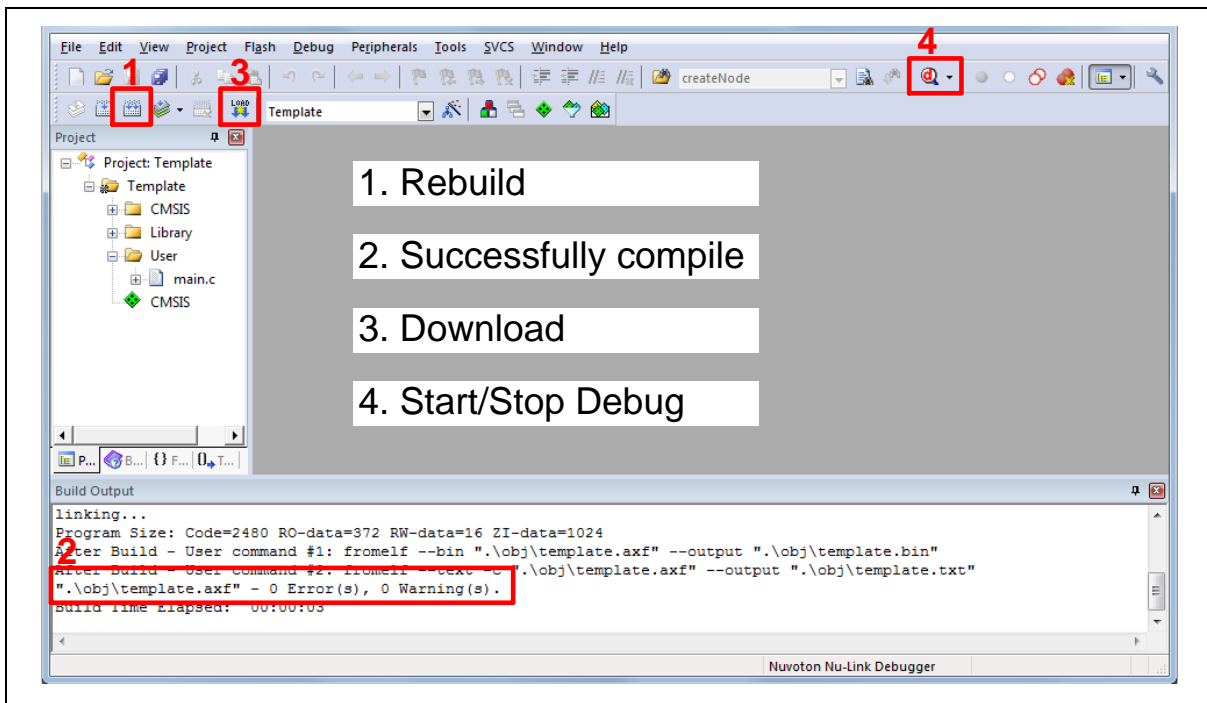


Figure 4-12 Compile and Download the Project

- Figure 4-13 shows the debug mode under Keil MDK. Click “Run” and the debug message will be printed out as shown in Figure 4-14. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc.

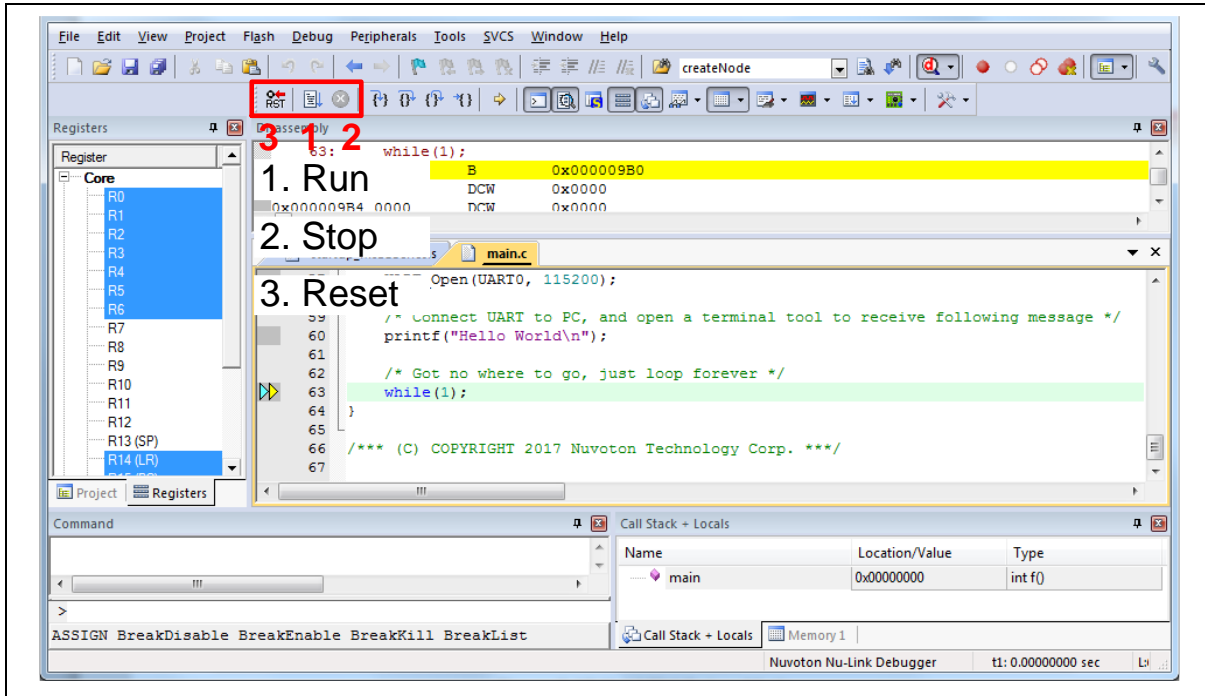


Figure 4-13 Keil MDK Debug Mode

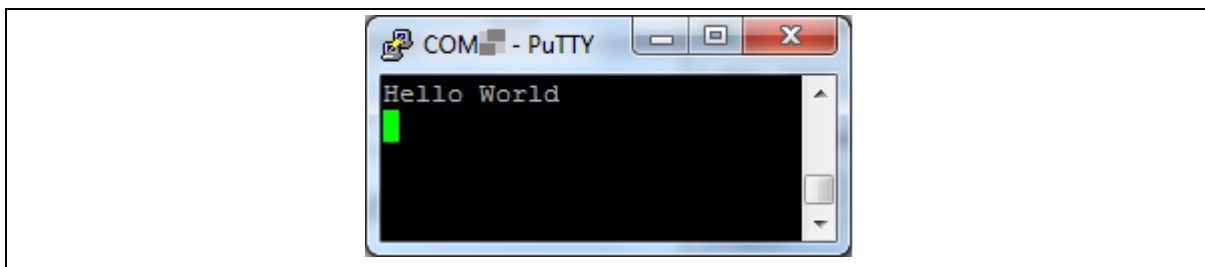


Figure 4-14 Debug Message on Serial Port Terminal Windows

4.6.2 IAR EWARM

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

1. Double click the “Template.eww” to open the project.
2. Make sure the toolbar contains “Nu-Link” item as shown in Figure 4-15.

Note: If the toolbar does not contain “Nu-Link” item, please rework section 4.2.

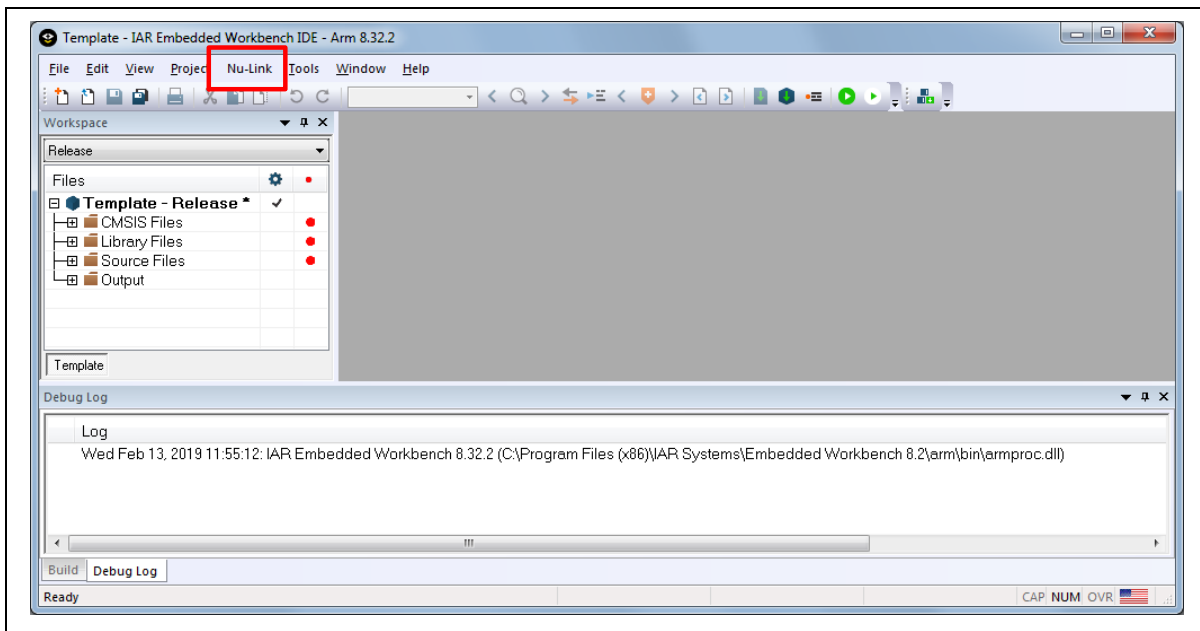


Figure 4-15 IAR EWARM Window

3. Make a target file as presented in Figure 4-16. After successfully compiling the project, download code to the Flash memory and enter debug mode.

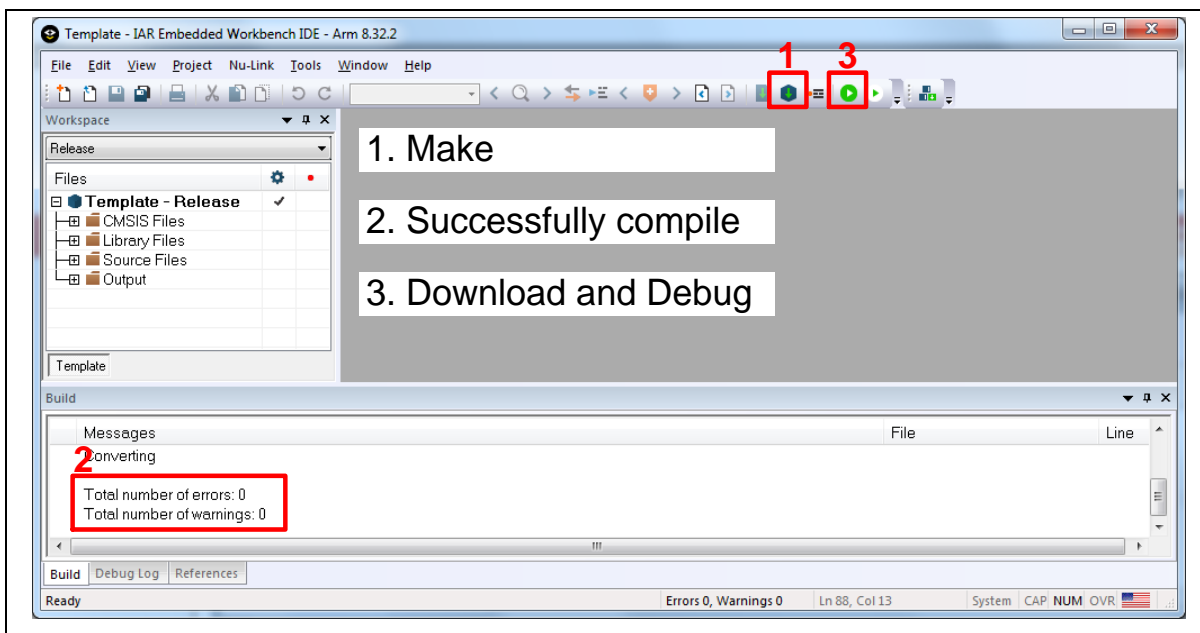


Figure 4-16 Compile and Download the Project

- Figure 4-17 shows the debug mode under IAR EWARN. Click “Go” and the debug message will be printed out as shown in Figure 4-18. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc.

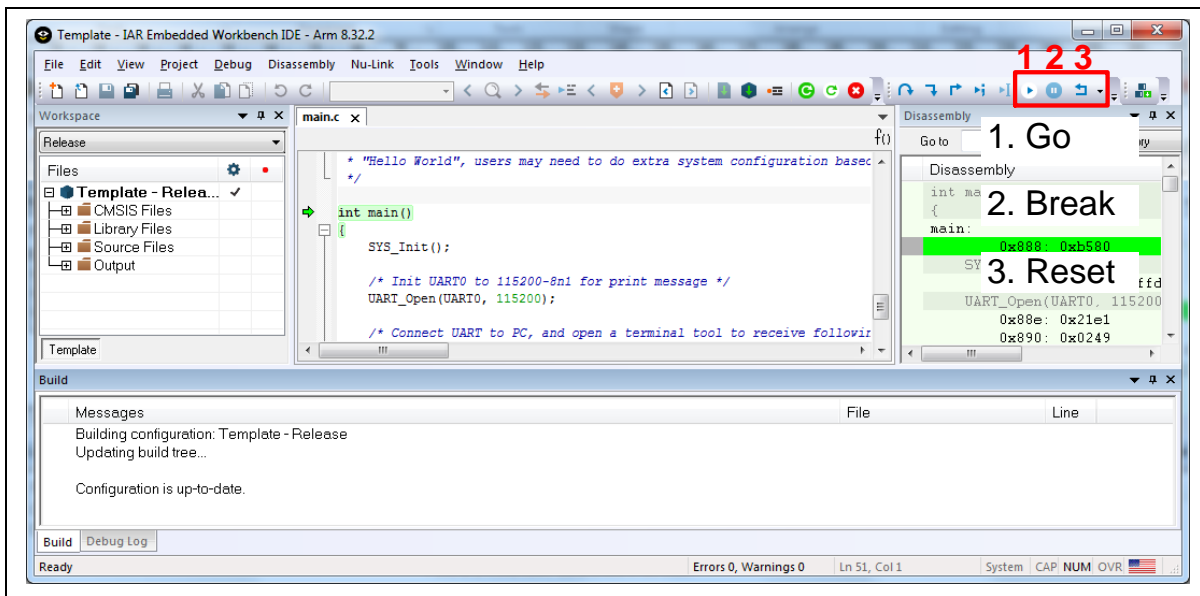


Figure 4-17 IAR EWARM Debug Mode

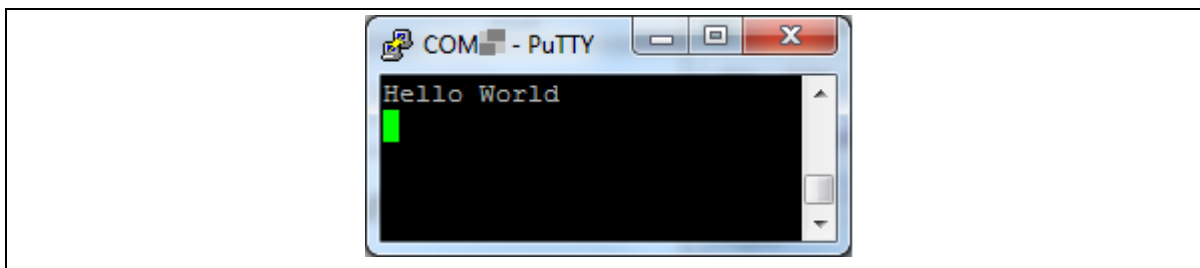


Figure 4-18 Debug Message on Serial Port Terminal Windows

4.6.3 NuEclipse

This section provides steps to beginners on how to run a project by using NuEclipse. Please make sure the filenames and project folder path contain neither invalid character nor space.

- Double-click “NuEclipse.exe” to open the toolchain.
- Import the “Template” project by following the steps presented in Figure 4-19 and Figure 4-20.

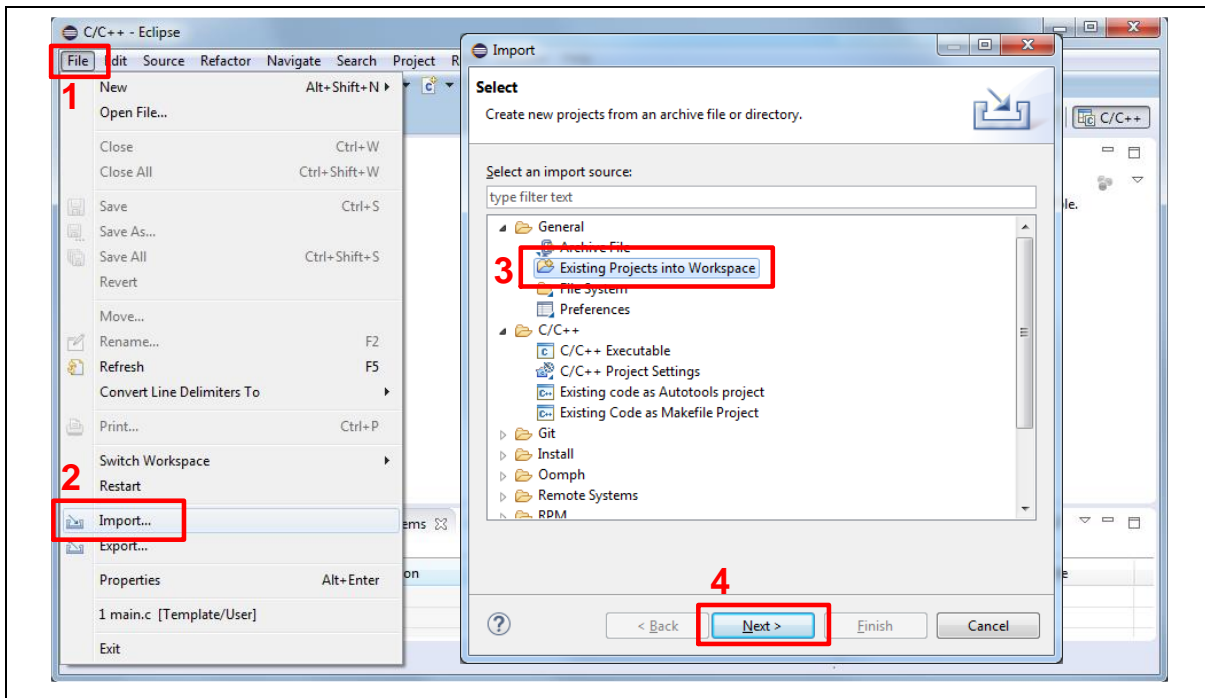


Figure 4-19 Import the Project in NuEclipse

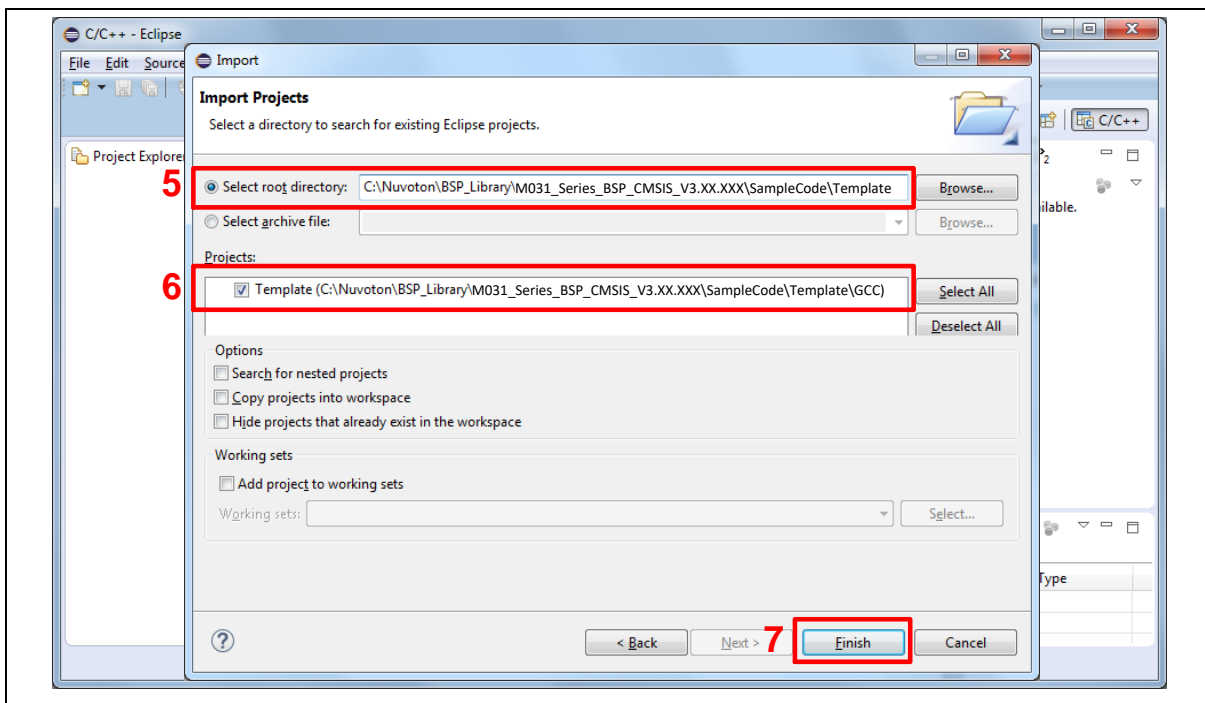


Figure 4-20 Import Projects Windows

3. Click the “Template” project and find the project properties as shown in Figure 4-21. Make sure the settings are the same as settings in Figure 4-22.

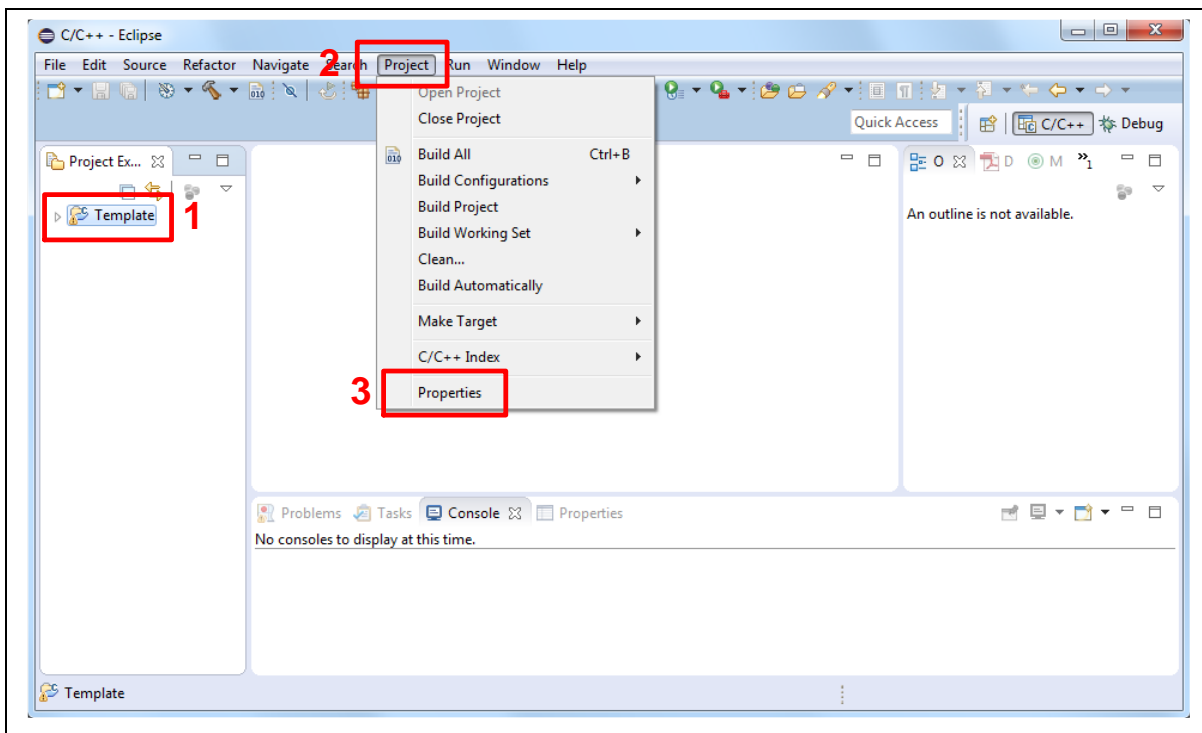


Figure 4-21 Open Project Properties Window

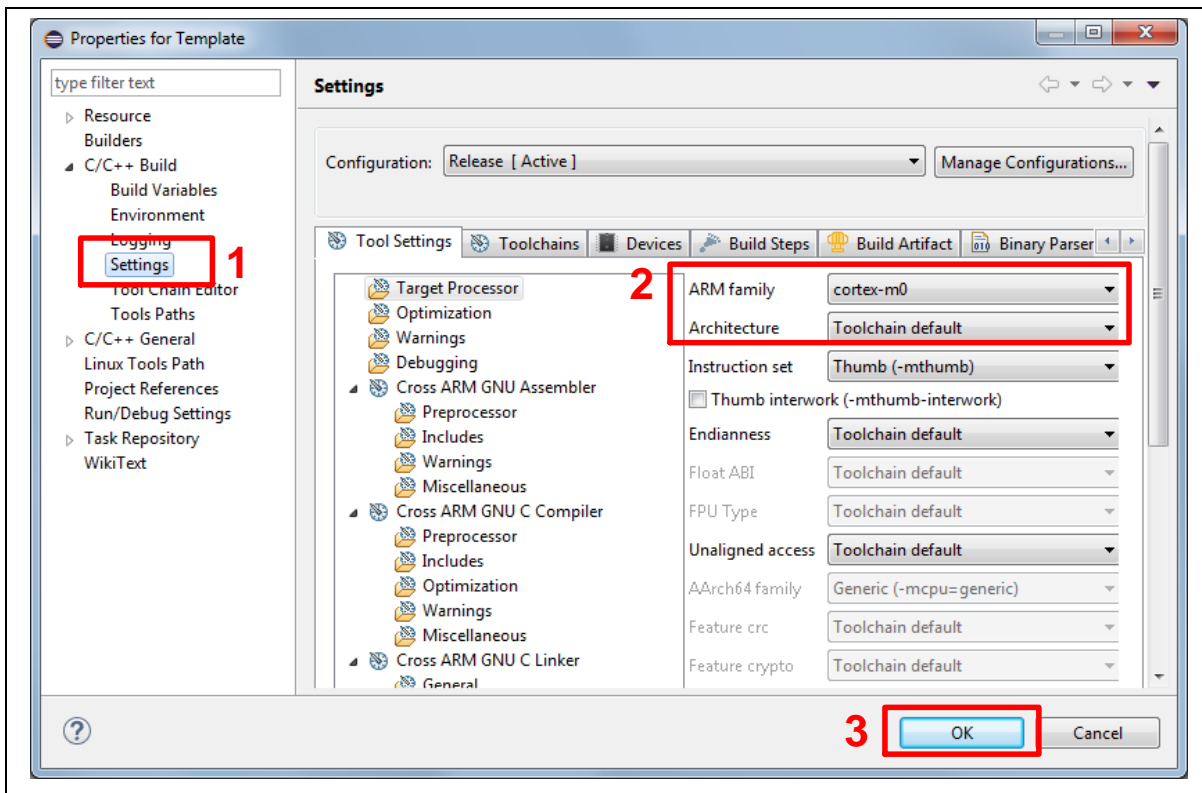


Figure 4-22 Project Properties Settings

4. Click the “Template” project and build the project.

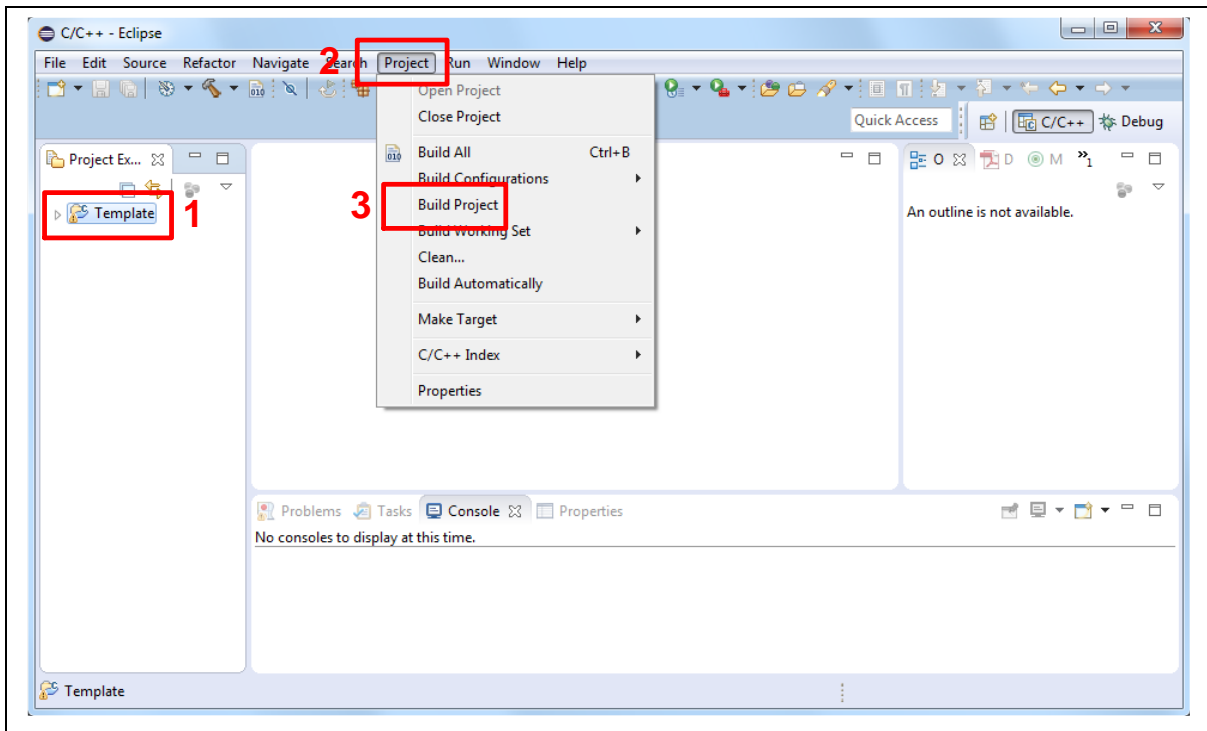


Figure 4-23 Build Project

5. After the project is built, click the “Template” project and set the “Debug Configuration” as shown in Figure 4-24. Follow the settings presented in Figure 4-25, Figure 4-26 and Figure 4-27 to enter debug mode.

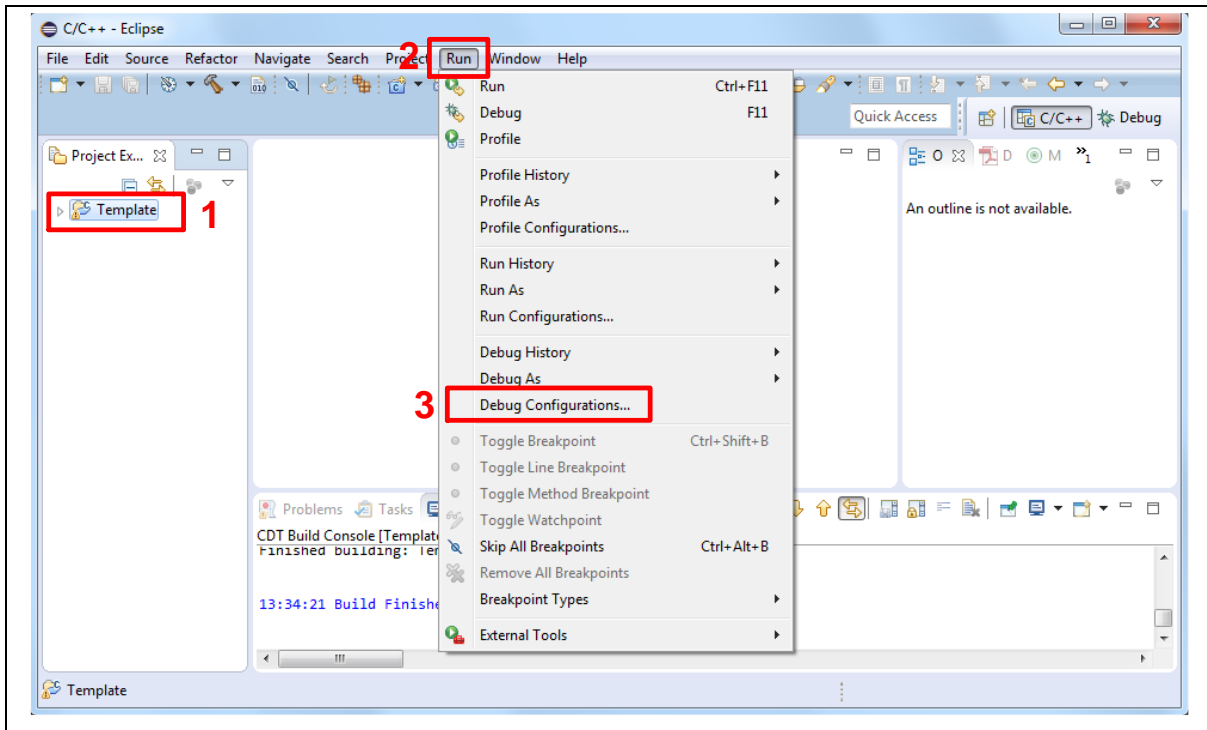
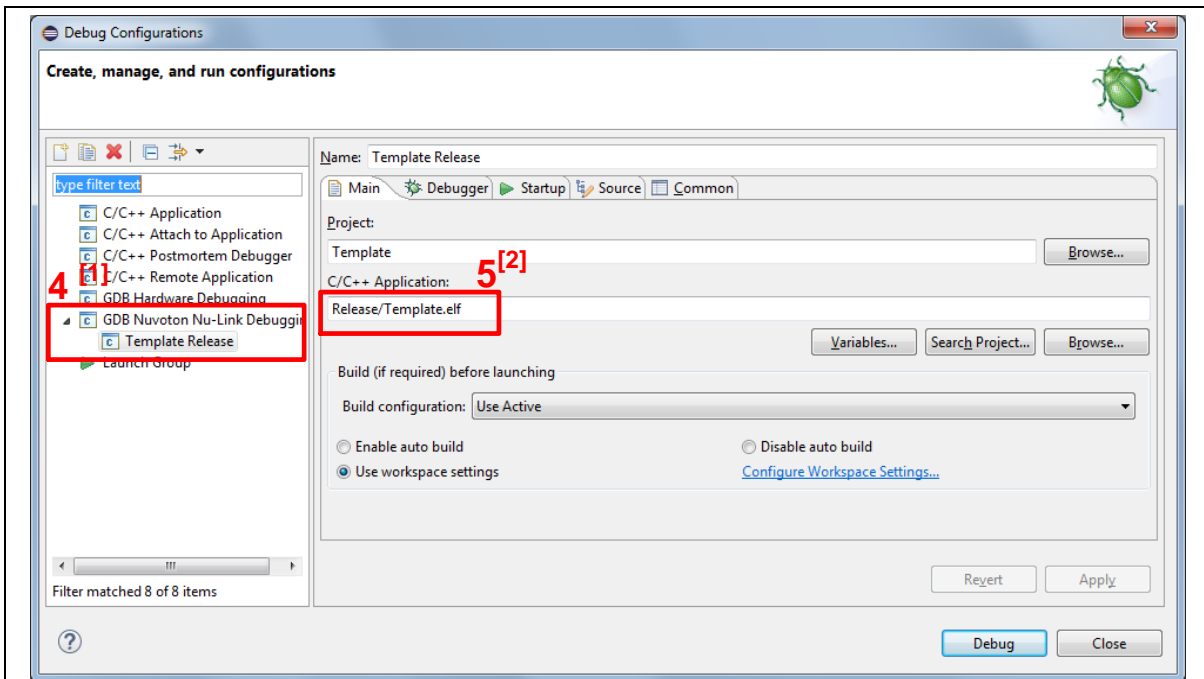


Figure 4-24 Open Debug Configuration



Note 1: Double-click the “GDB Nuvoton Nu-Link Debugging” to create the sub item.

Note 2: After the project is built, the “*.elf” file will be shown in “C/C++ Application” frame.

Figure 4-25 Main Tab Configuration

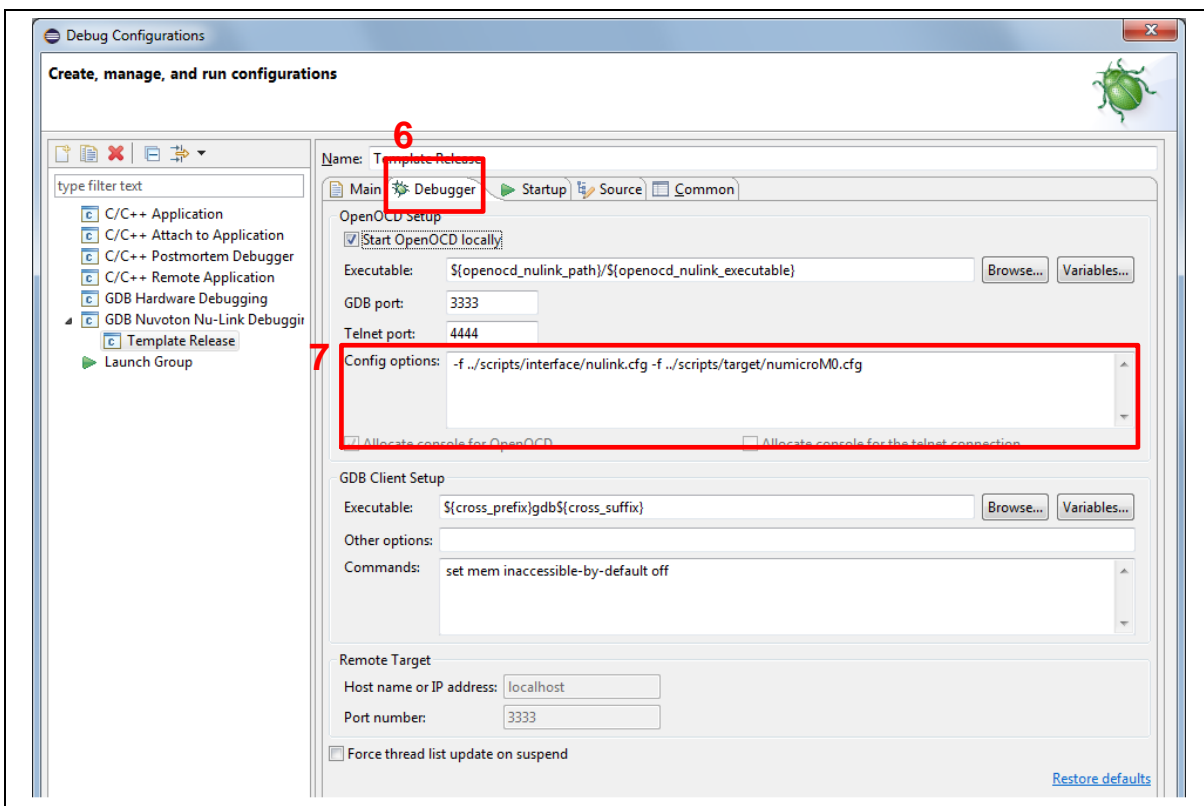
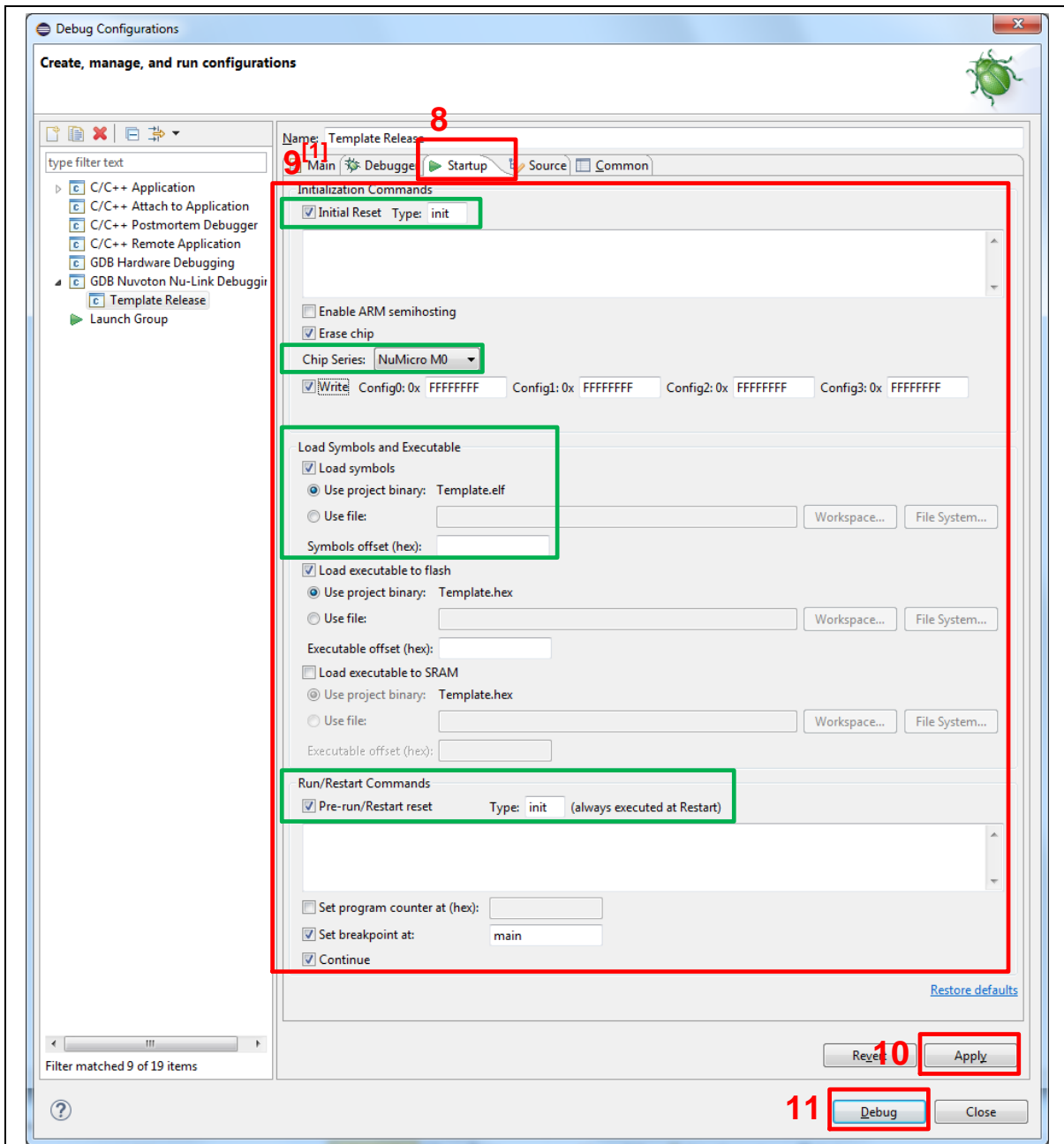


Figure 4-26 Debugger Tab Configuration



Note: User must follow those settings highlighted in green, and configure other settings depending on the needs.

Figure 4-27 Startup Tab Configuration

6. Figure 4-28 shows the debug mode under NuEclipse. Click “Resume” and the debug message will be printed out as shown in Figure 4-29. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc. For more information about how to use NuEclipse, please refer to the *NuEclipse User Manual*.

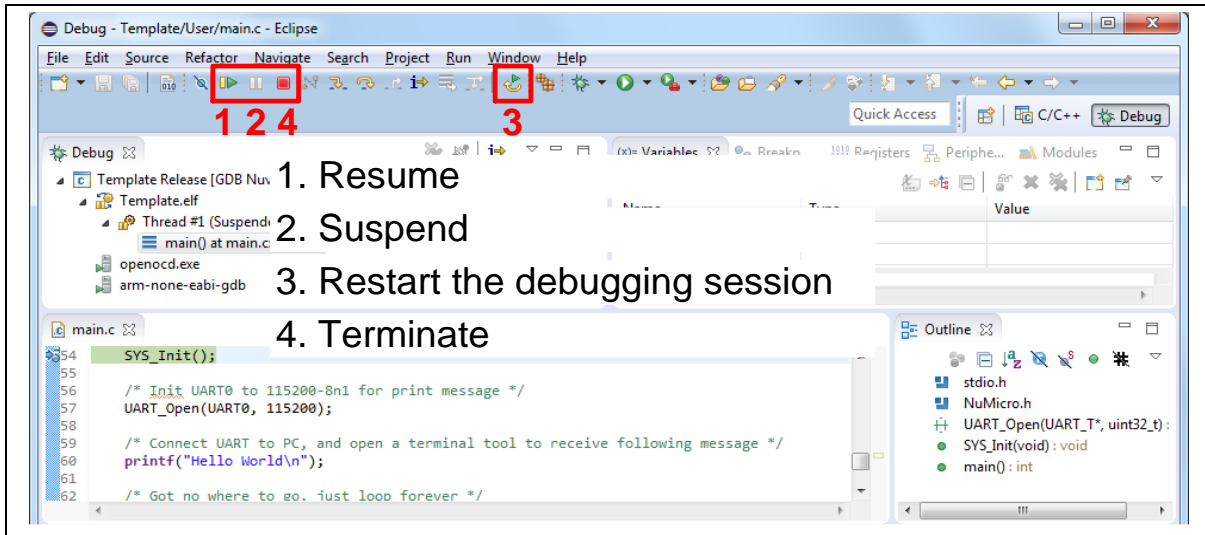


Figure 4-28 NuEclipse Debug Mode

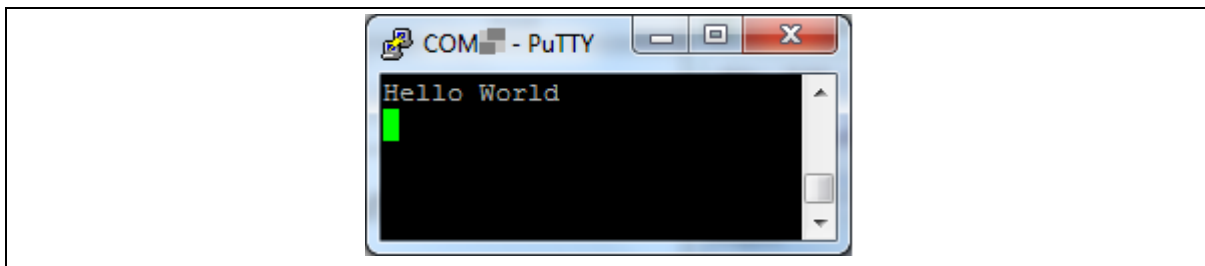
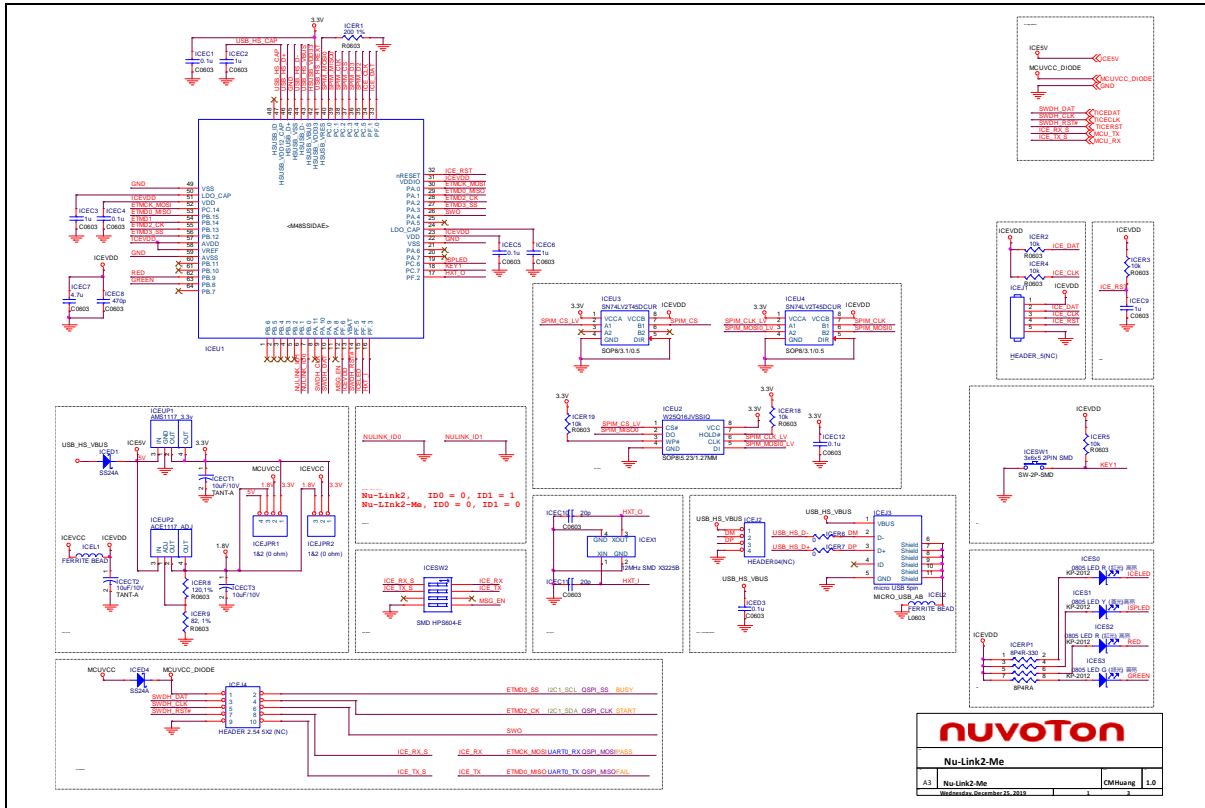


Figure 4-29 Debug Message on Serial Port Terminal Windows

5 NUMAKER-M256SD SCHEMATICS

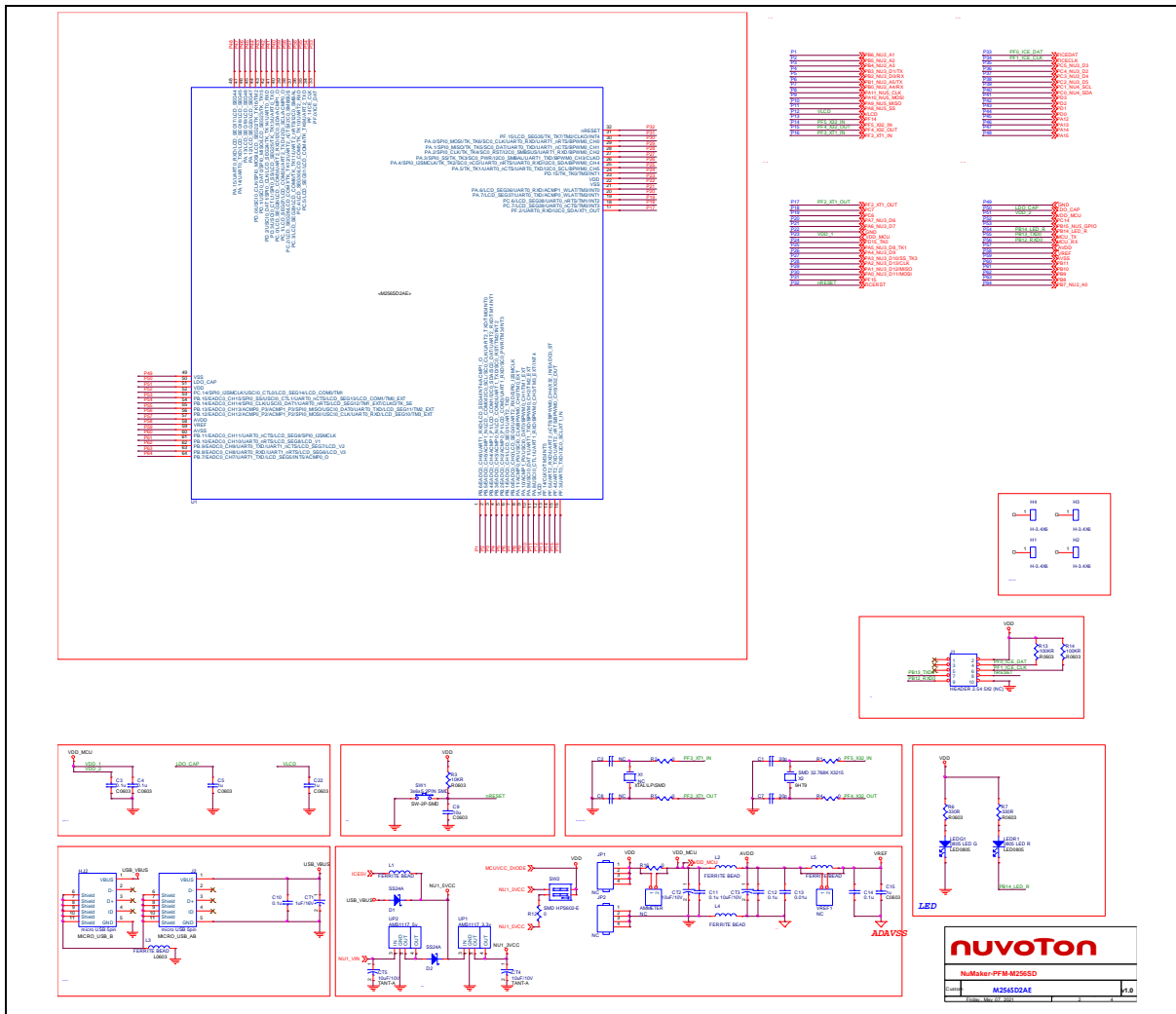
5.1 Nu-Link2-Me

Figure 5-1 shows the Nu-Link2-Me circuit.



5.2 M256SD Target Board

Figure 5-2 shows the M256SD target board circuit.



5.3 Extension Connectors

Figure 5-3 shows extension connectors of NuMaker-M256SD.

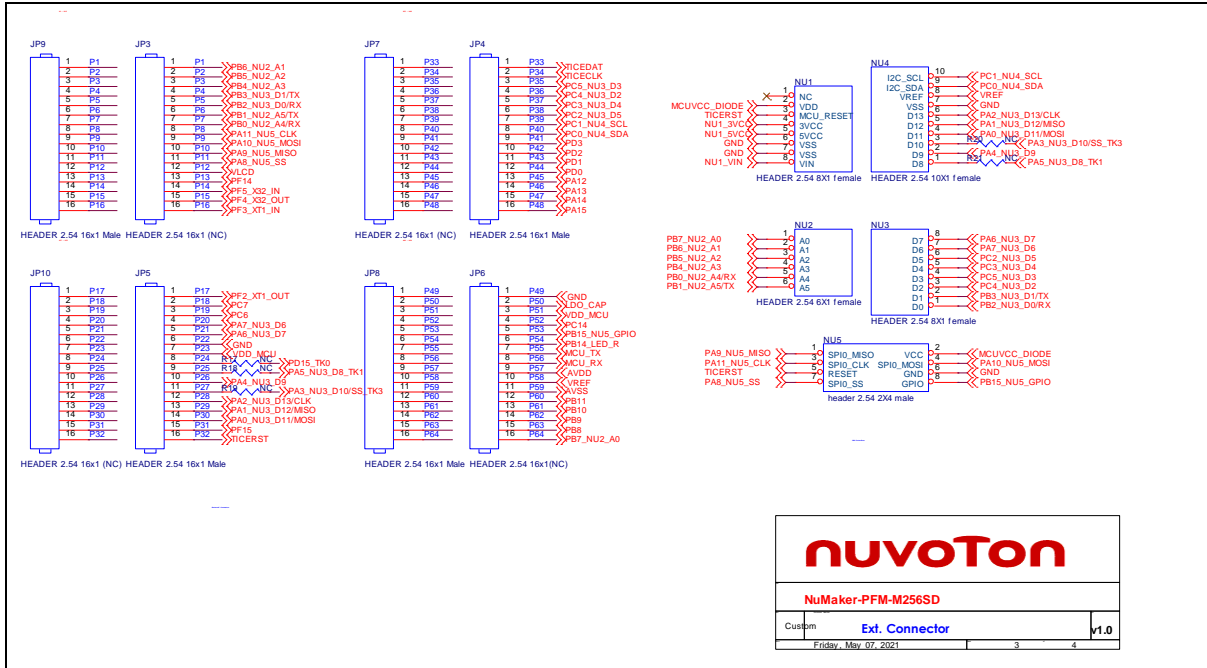


Figure 5-3 Extension Connectors Circuit

5.4 Touch Key

Figure 5-4 shows touch key of NuMaker-M256SD.

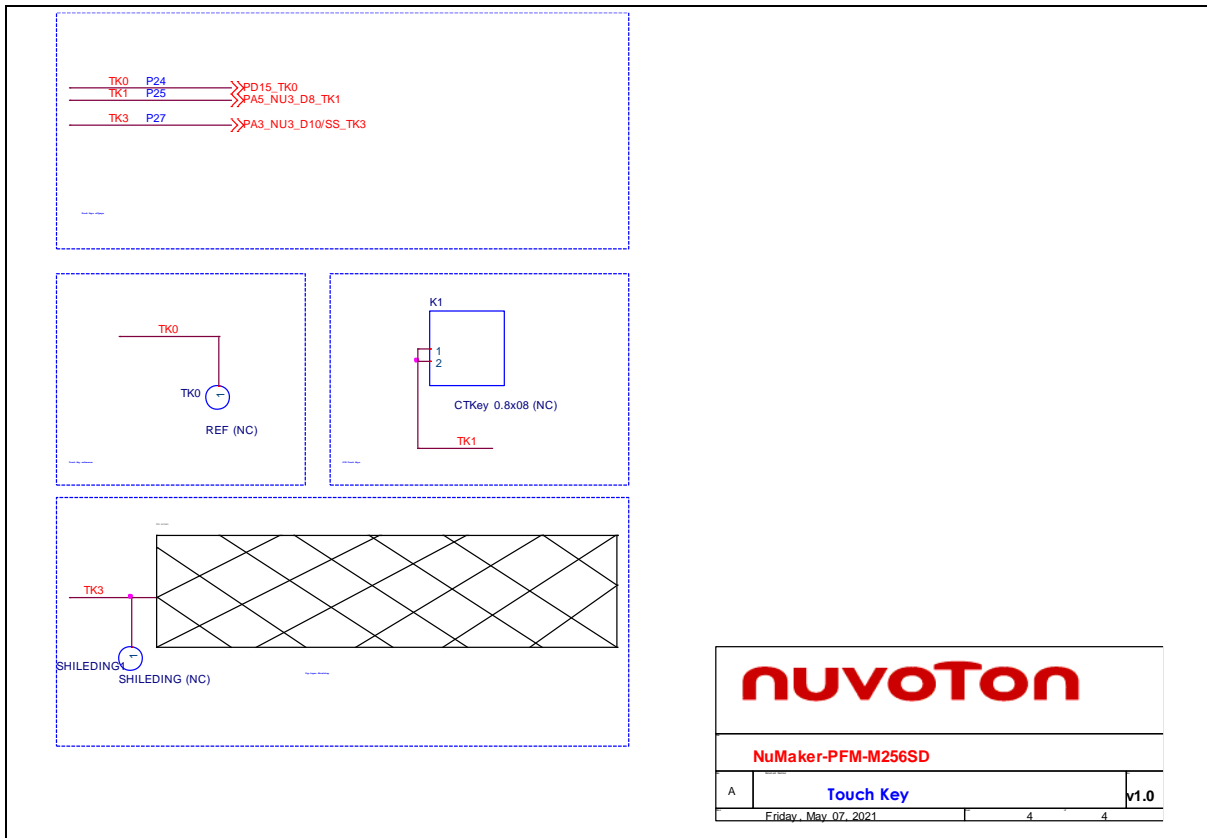


Figure 5-4 Touch Key Circuit

5.5 PCB Placement

Figure 5-5 and Figure 5-6 show the front and rear placement of NuMaker-M256SD.

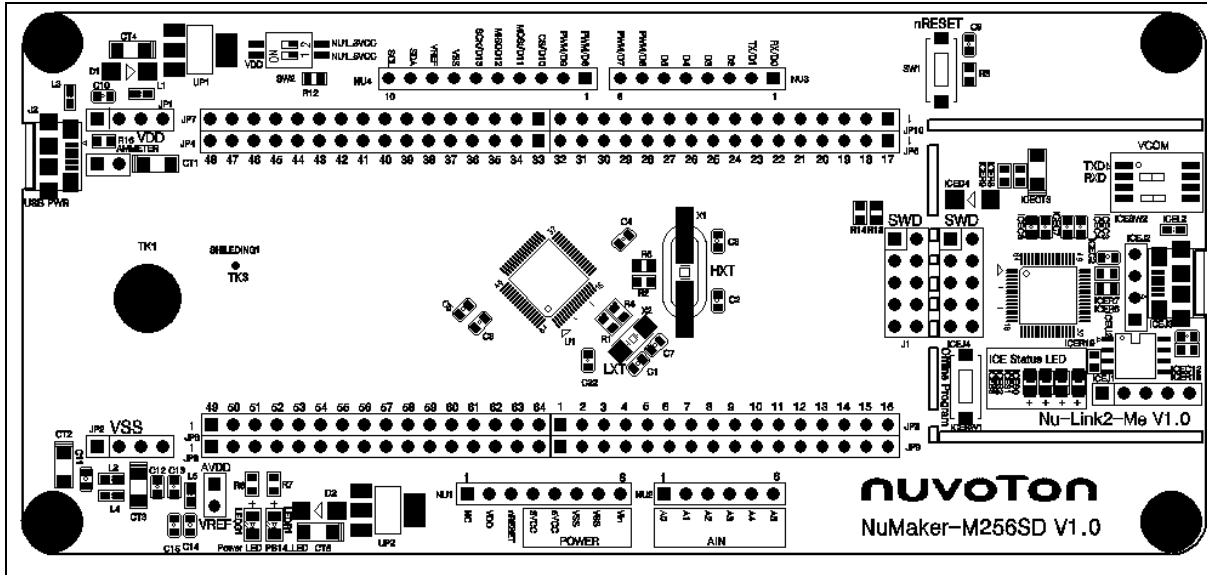


Figure 5-5 Front Placement

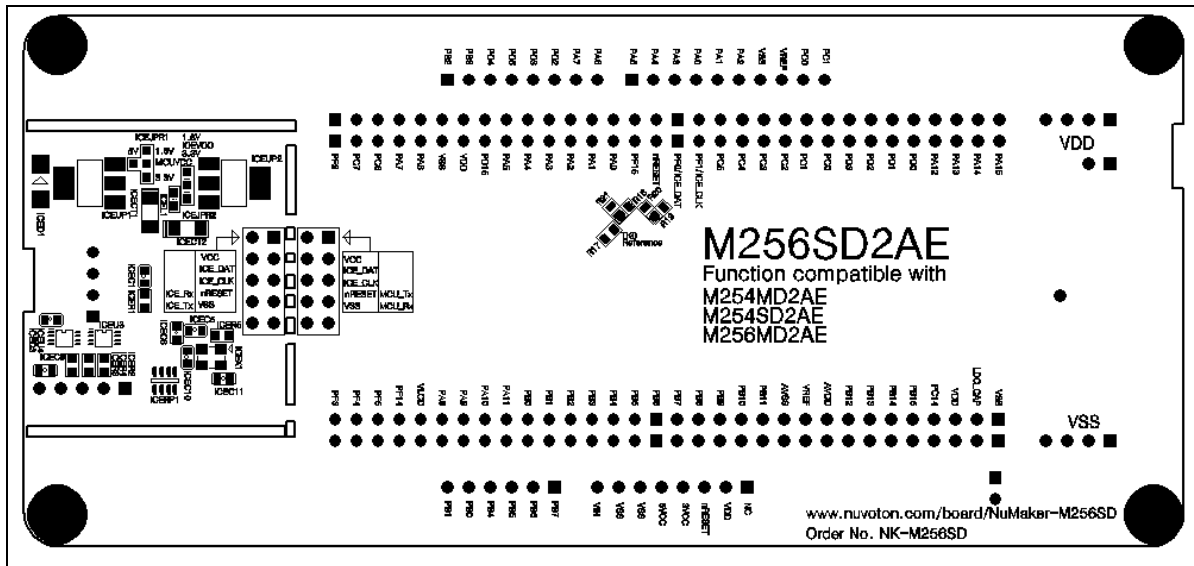


Figure 5-6 Rear Placement

6 REVISION HISTORY

| Date | Revision | Description |
|------------|----------|------------------|
| 2022.05.20 | 1.00 | Initial version. |

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