NuMicro® Family

Arm® Cortex®-M23-based Microcontroller

NuMaker-M256SD

User Manual

Evaluation Board for NuMicro® M254/256/258 Series

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

www.nuvoton.com

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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.

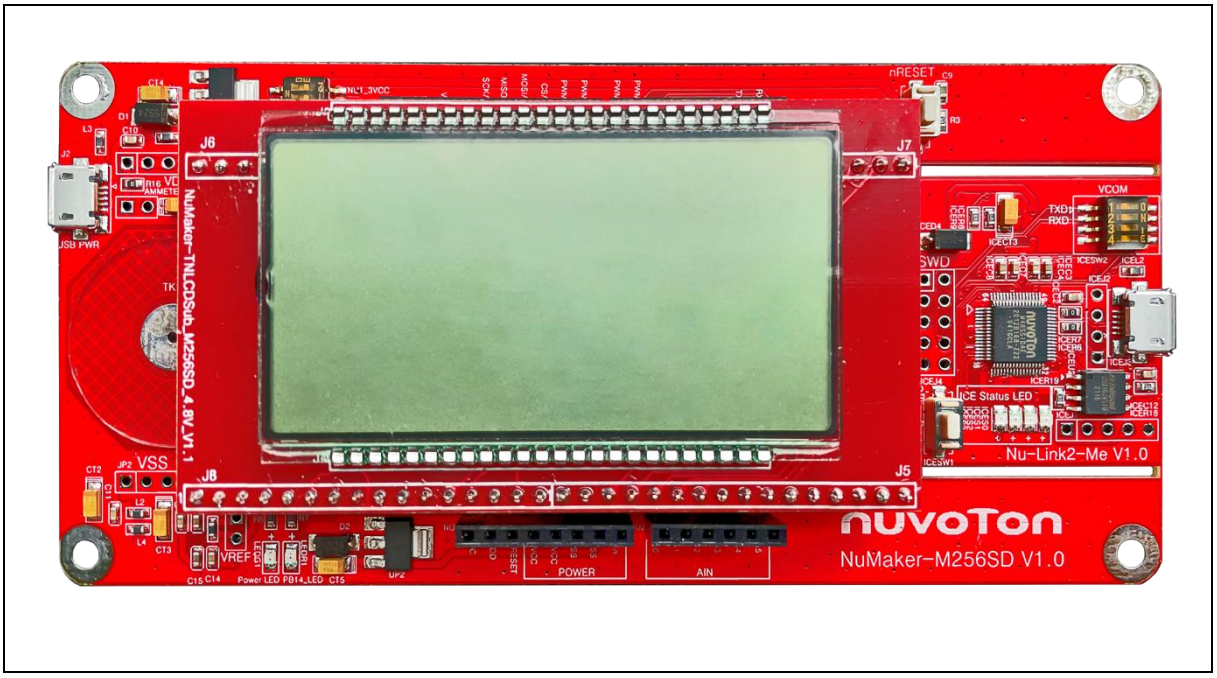


Figure 1-1 NuMaker-M256SD Evaluation Board

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 Vin
  - 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

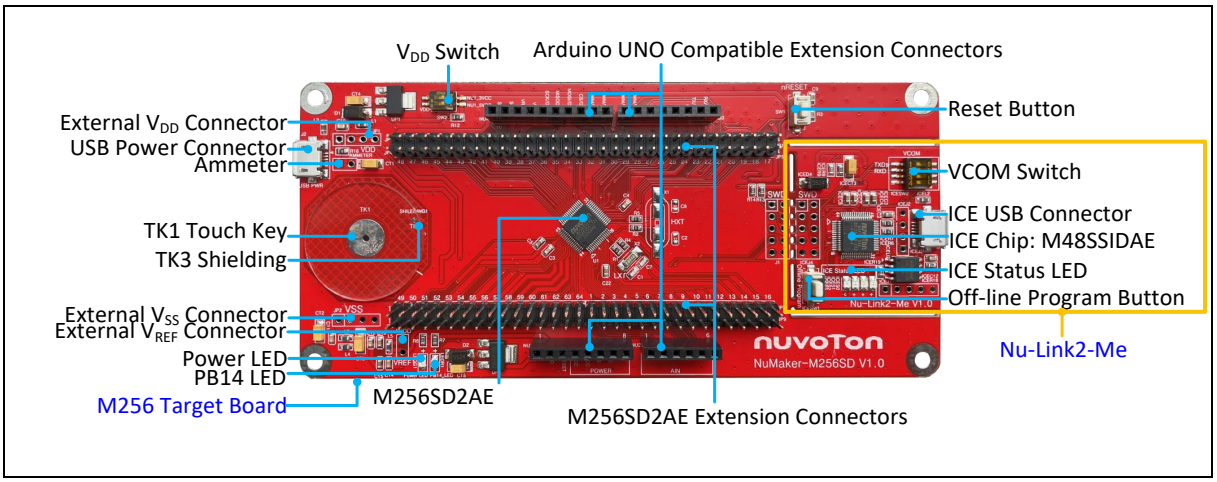


Figure 3-1 Front View of NuMaker-M256SD

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)

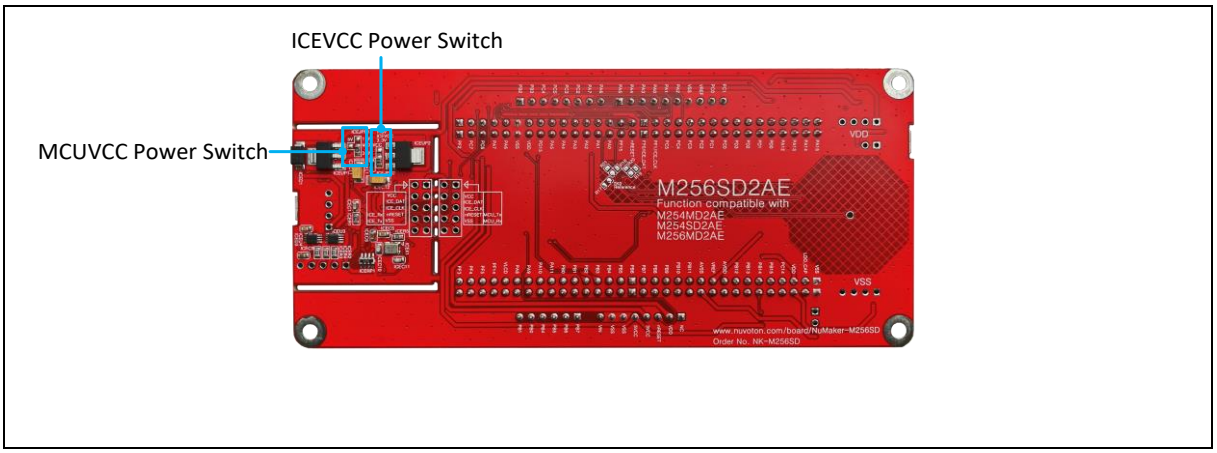


Figure 3-2 Rear View of NuMaker-M256SD

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.

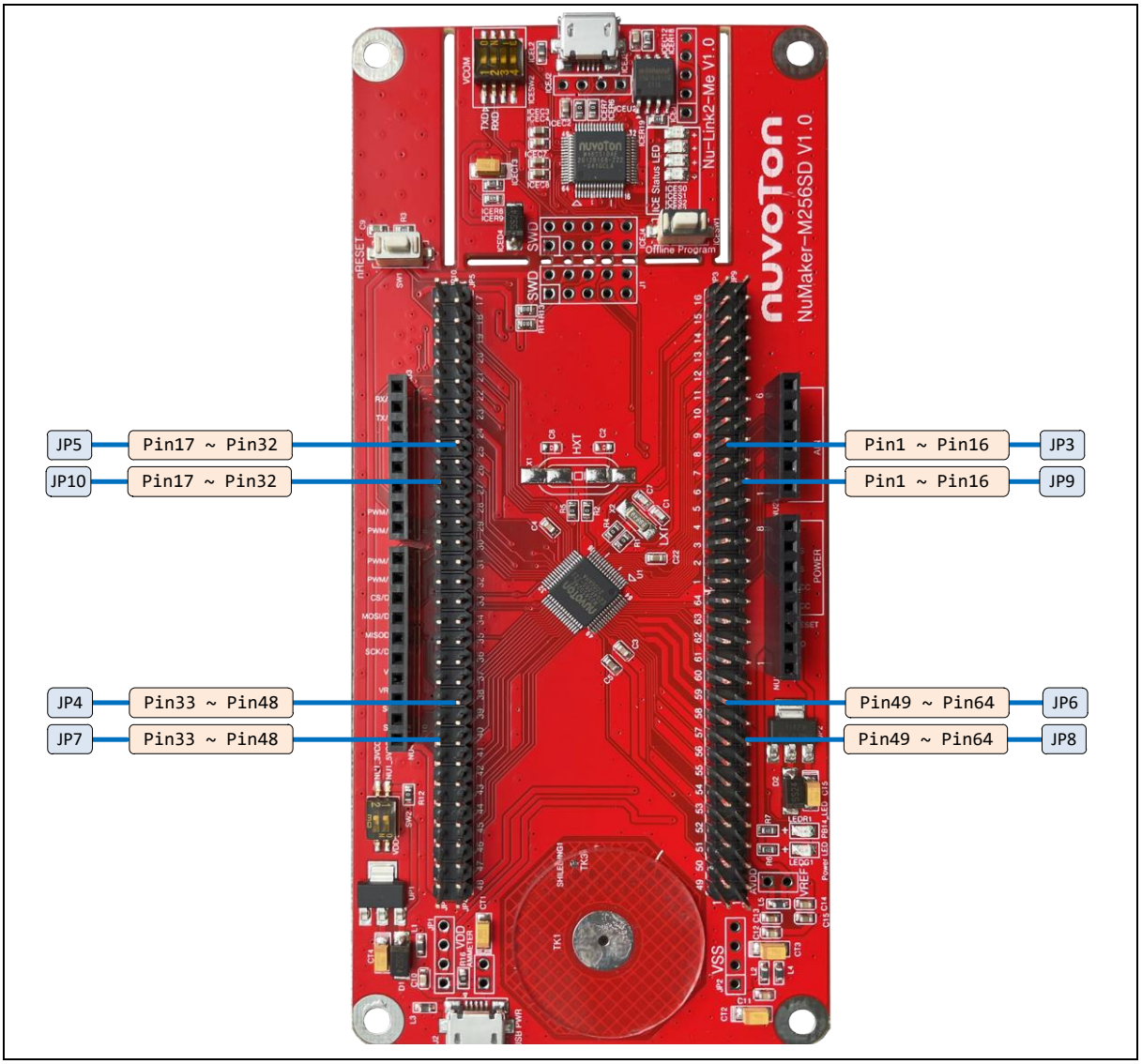


Figure 3-3 M256SD2AE Extension Connectors

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_{DD}
	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_SMBSUS/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	JP7.3	35	PC.5/LCD_SEG31/LCD_COM4/TK_TK9/UART2_TXD
	JP4.4	JP7.4	36	PC.4/LCD_SEG30/LCD_COM5/TK_TK10/UART2_RXD
	JP4.5	JP7.5	37	PC.3/LCD_SEG29/LCD_COM6/TK_TK11/UART2_nRTS/I2C0_SMBAL
	JP4.6	JP7.6	38	PC.2/LCD_SEG28/LCD_COM7/TK_TK12/UART2_nCTS/I2C0_SMBSUS
	JP4.7	JP7.7	39	PC.1/LCD_SEG27/LCD_COM2/UART2_TXD/I2C0_SCL/ACMP0_O
	JP4.8	JP7.8	40	PC.0/LCD_SEG26/LCD_COM3/UART2_RXD/I2C0_SDA/ACMP1_O
	JP4.9	JP7.9	41	PD.3/USCI0_CTL1/SPI0_SS/LCD_SEG25/TK_TK13/UART0_TXD
	JP4.10	JP7.10	42	PD.2/USCI0_DAT1/SPI0_CLK/LCD_SEG24/TK_TK14/UART0_RXD
	JP4.11	JP7.11	43	PD.1/USCI0_DAT0/SPI0_MISO/LCD_SEG23/TK_TK15
	JP4.12	JP7.12	44	PD.0/USCI0_CLK/SPI0_MOSI/LCD_SEG22/TK_TK16/TM2
	JP4.13	JP7.13	45	PA.12/LCD_SEG20/LCD_SEG47
	JP4.14	JP7.14	46	PA.13/LCD_SEG19/LCD_SEG46
	JP4.15	JP7.15	47	PA.14/UART0_TXD/LCD_SEG18/LCD_SEG45
	JP4.16	JP7.16	48	PA.15/UART0_RXD/LCD_SEG17/LCD_SEG44
JP6 JP8	JP6.1	JP8.1	49	V_{SS}
	JP6.2	JP8.2	50	LDO_CAP
	JP6.3	JP8.3	51	V_{DD}
	JP6.4	JP8.4	52	PC.14/SPI0_I2SMCLK/USCI0_CTL0/LCD_SEG14/LCD_COM0/TM1
	JP6.5	JP8.5	53	PB.15/EADC0_CH15/SPI0_SS/USCI0_CTL1/UART0_nCTS/LCD_SEG13/LCD_COM1/TM0_EXT
	JP6.6	JP8.6	54	PB.14/EADC0_CH14/SPI0_CLK/USCI0_DAT1/UART0_nRTS/LCD_SEG12/TM1_EXT/CLKO/TK_SE
	JP6.7	JP8.7	55	PB.13/EADC0_CH13/ACMP0_P3/ACMP1_P3/SPI0_MISO/USCI0_DAT0/UART0_TXD/LCD_SEG11/TM2_EXT
	JP6.8	JP8.8	56	PB.12/EADC0_CH12/ACMP0_P2/ACMP1_P2/SPI0_MOSI/USCI0_CLK/UART0_RXD/LCD_SEG10/TM3_EXT
	JP6.9	JP8.9	57	AV_{DD}
	JP6.10	JP8.10	58	V_{REF}
	JP6.11	JP8.11	59	AV_{SS}
	JP6.12	JP8.12	60	PB.11/EADC0_CH11/UART0_nCTS/LCD_SEG9/SPI0_I2SMCLK
	JP6.13	JP8.13	61	PB.10/EADC0_CH10/UART0_nRTS/LCD_SEG8/LCD_V1
	JP6.14	JP8.14	62	PB.9/EADC0_CH9/UART0_TXD/UART1_nCTS/LCD_SEG7/LCD_V2
	JP6.15	JP8.15	63	PB.8/EADC0_CH8/UART0_RXD/UART1_nRTS/LCD_SEG6/LCD_V3
	JP6.16	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.

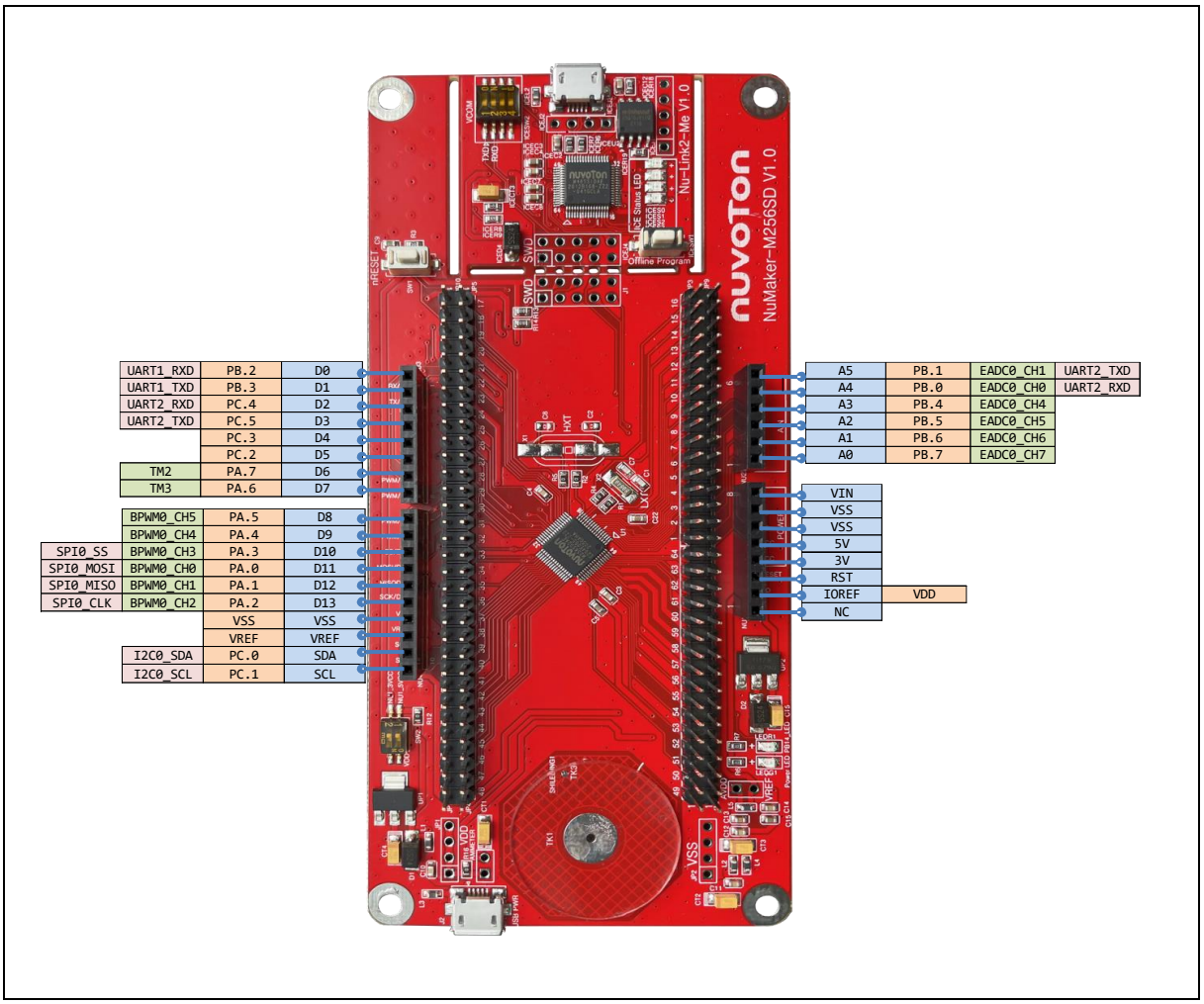


Figure 3-4 Arduino UNO Compatible Extension Connectors

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.

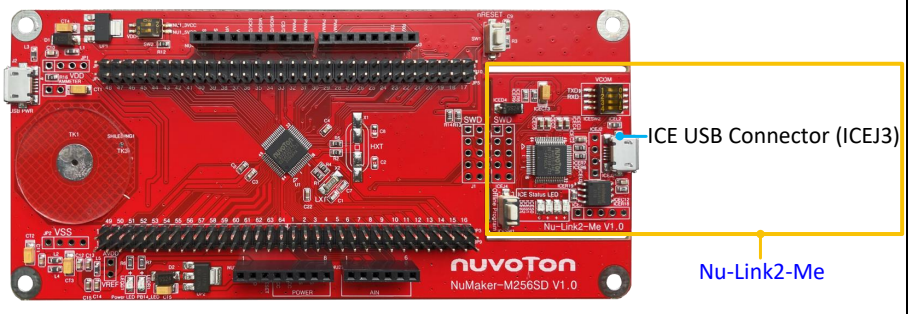


Figure 3-5 External Power Supply Sources on Nu-Link2-Me

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.

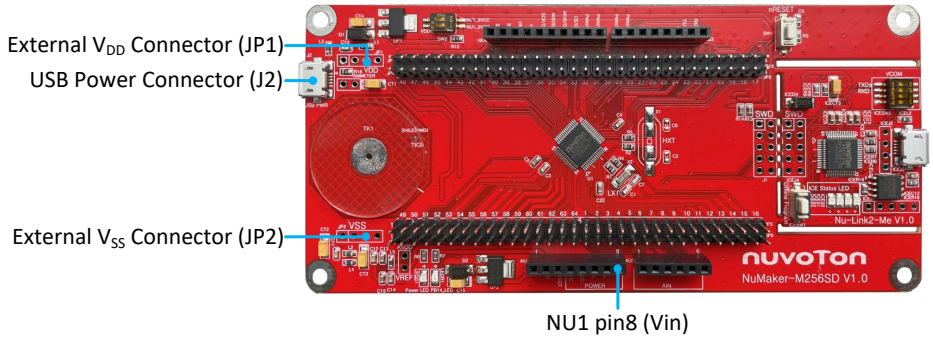


Figure 3-6 External Power Supply Sources on M256SD Target Board

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.

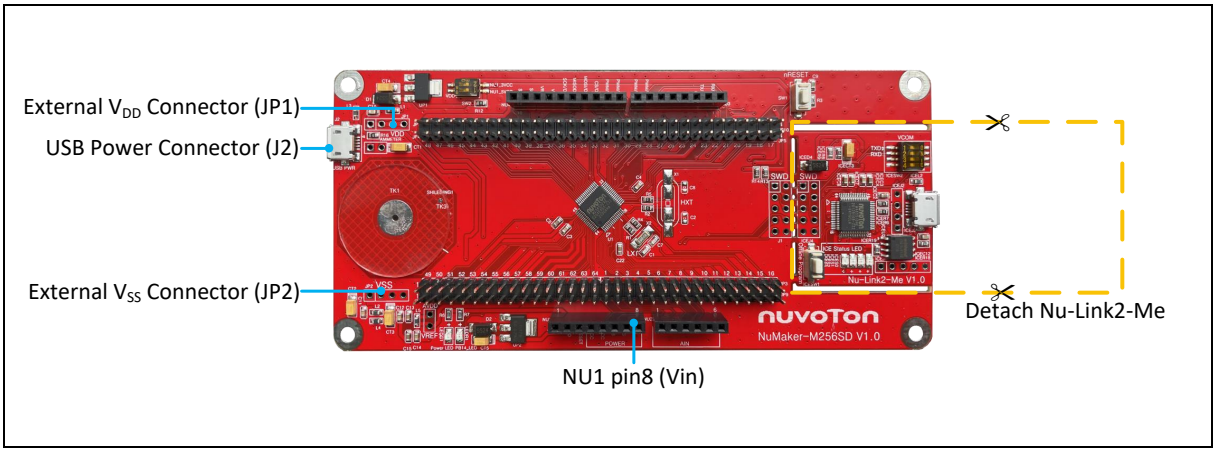


Figure 3-7 Detach the Nu-Link2-Me from NuMaker-M256SD

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 MCUVCC 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

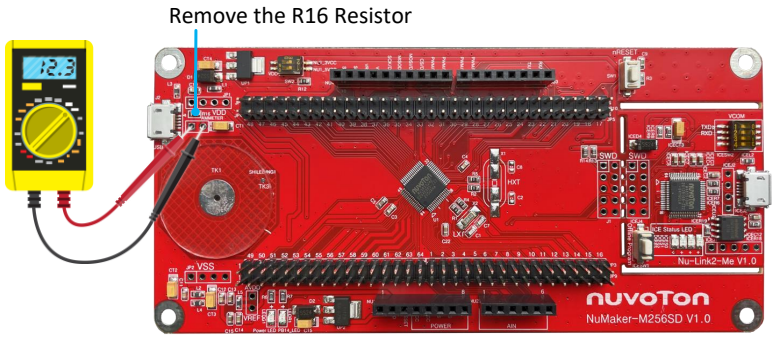


Figure 3-8 Wiring between Ammeter Connector and Ammeter

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.

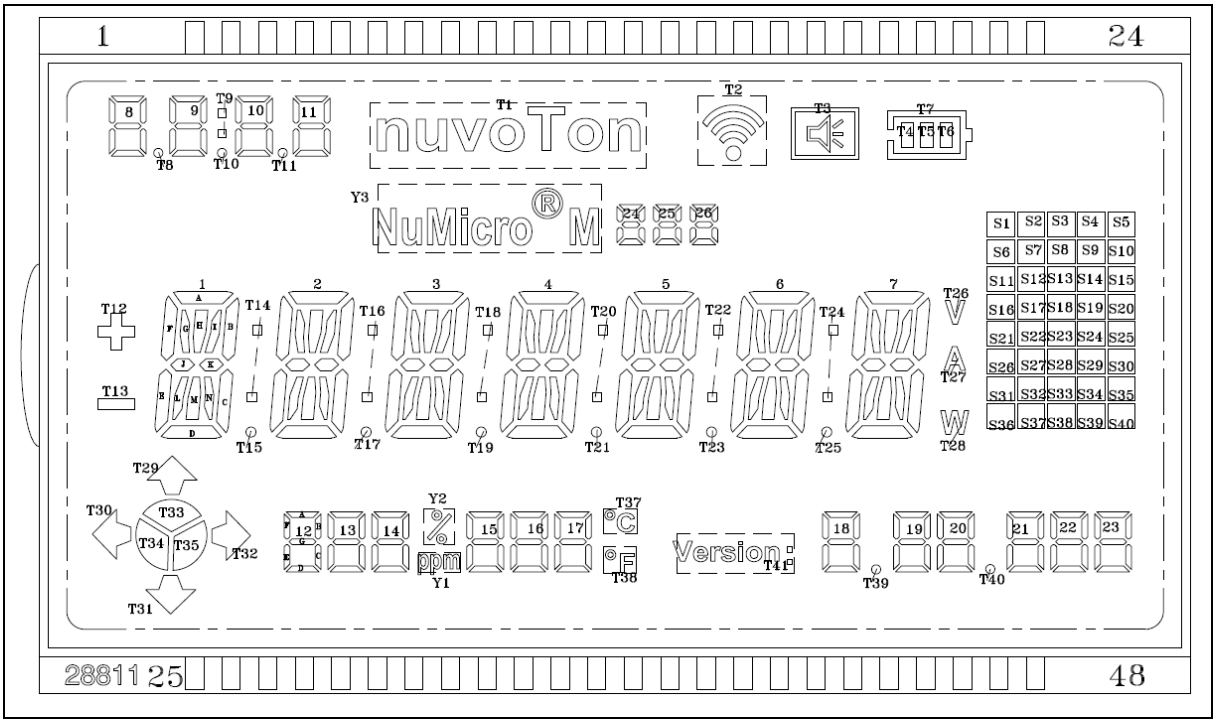


Figure 3-9 LCD Digit Segment Mapping

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.

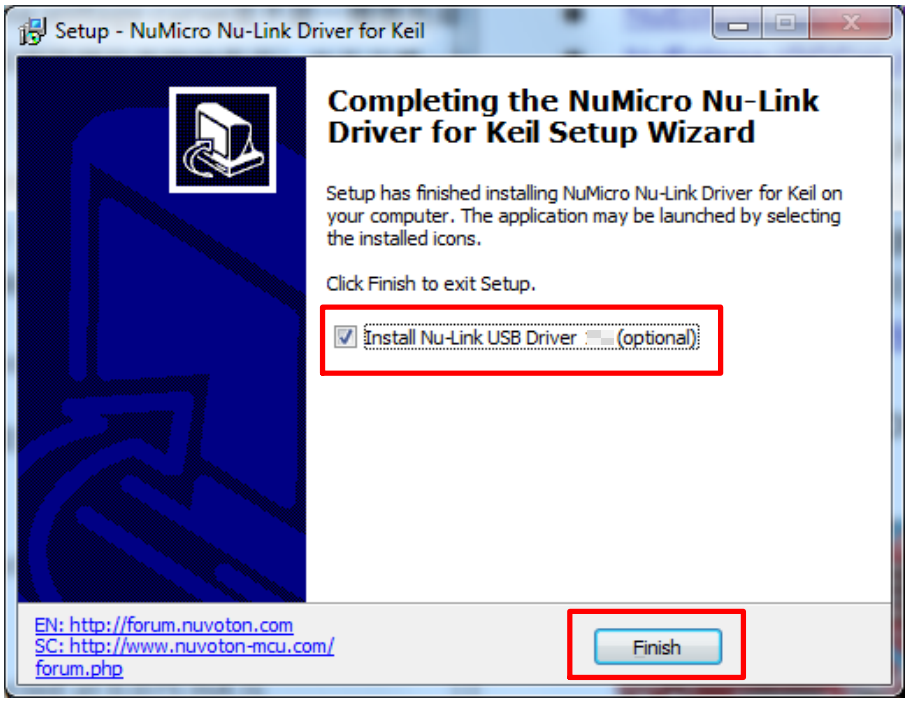


Figure 4-1 Nu-Link USB Driver Installation Setup

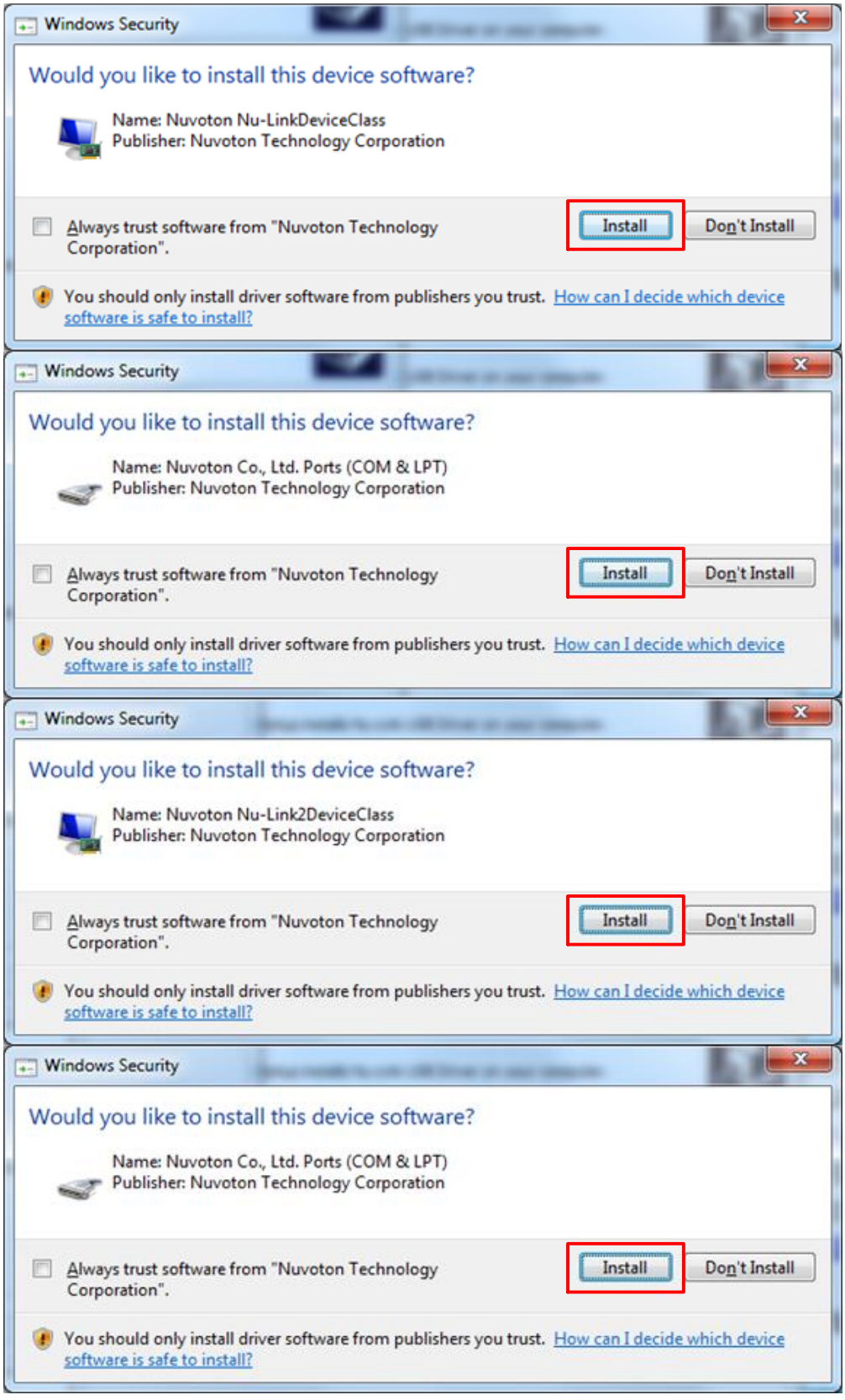


Figure 4-2 Nu-Link USB Driver Installation

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.

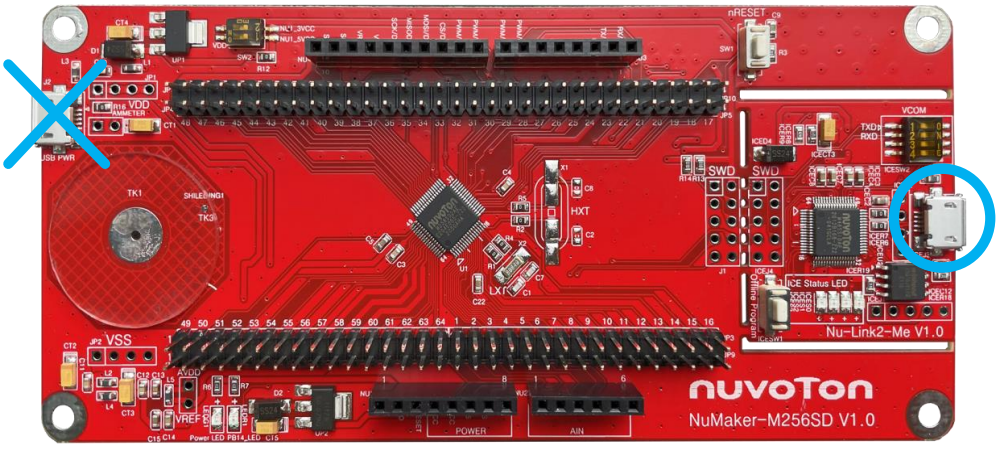


Figure 4-4 ICE USB Connector

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

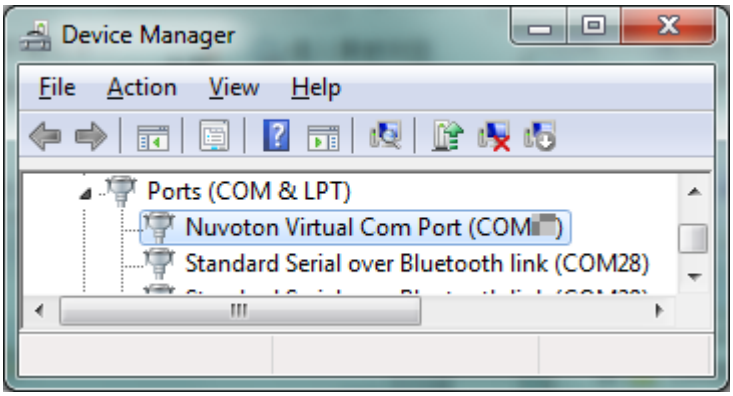


Figure 4-5 Device Manger

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.

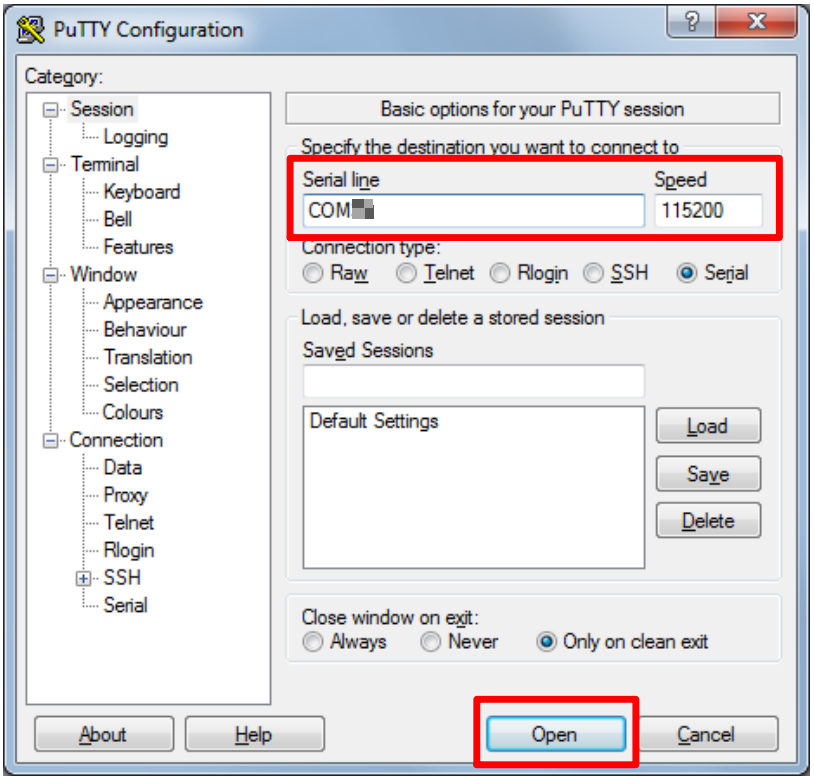


Figure 4-6 PuTTY Session Setting

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.

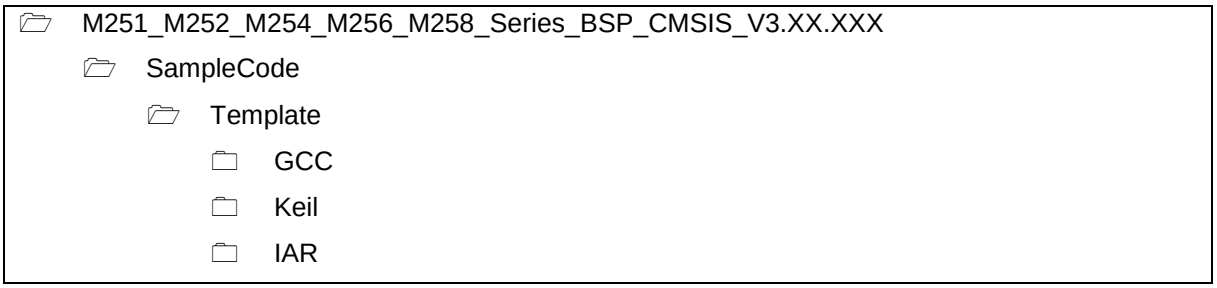


Figure 4-7 Template Project Folder Path

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.

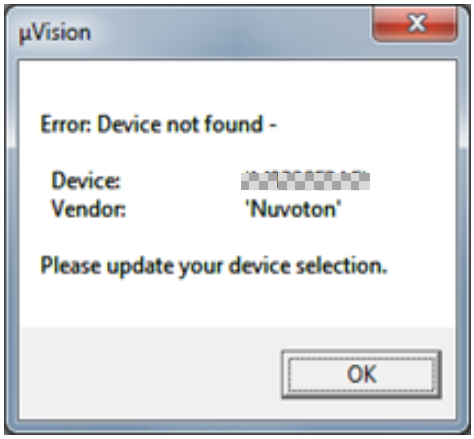


Figure 4-8 Warning Message of “Device not found”

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”.

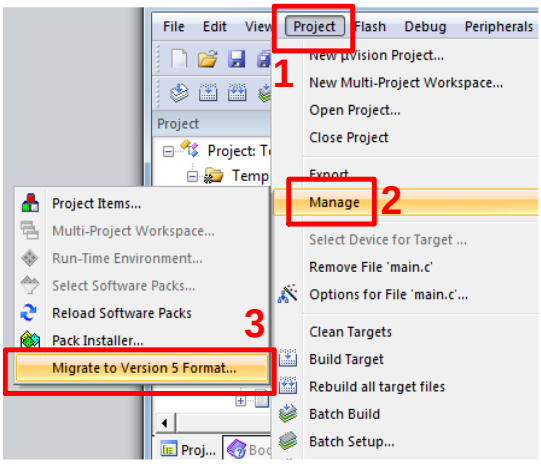


Figure 4-9 Project File Migrate to Version 5 Format

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

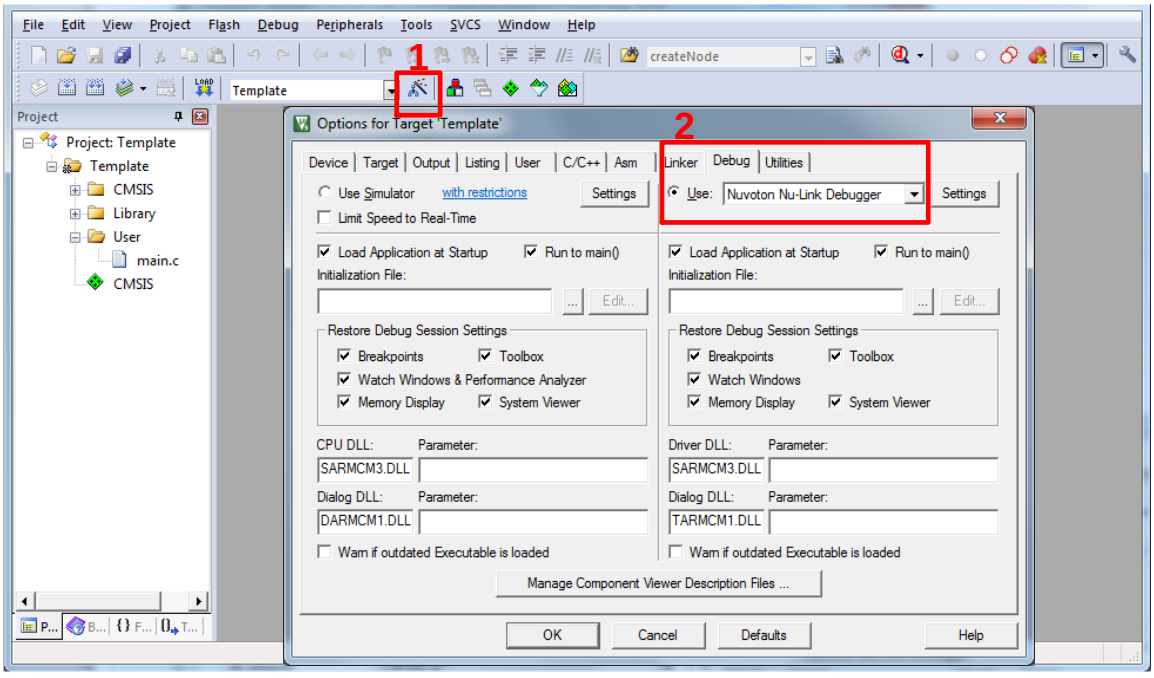


Figure 4-10 Debugger Setting in Options Window

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

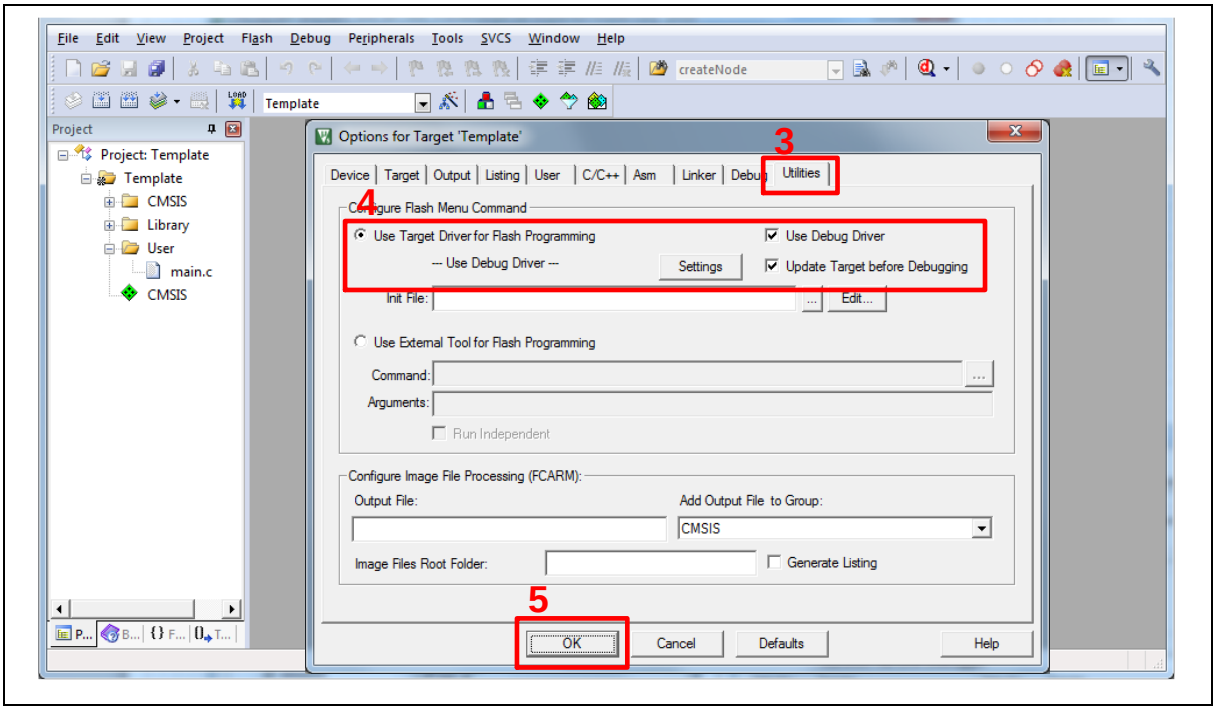


Figure 4-11 Programming Setting in Options Window

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.

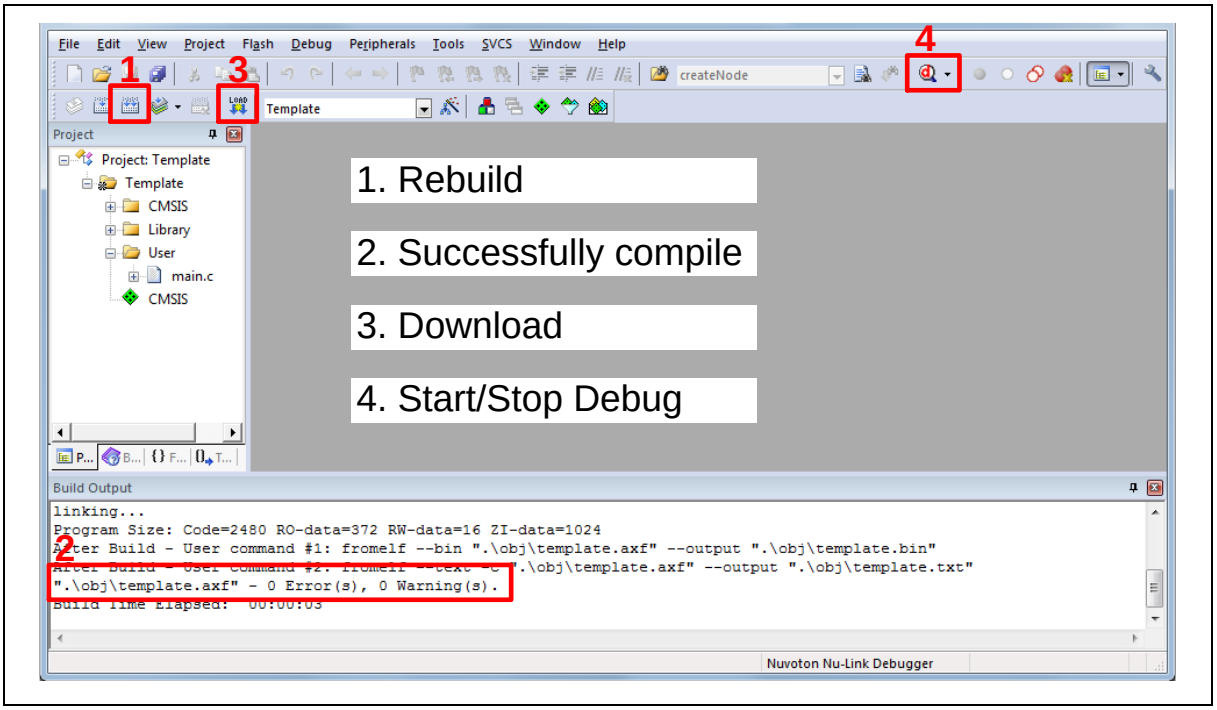


Figure 4-12 Compile and Download the Project

4. 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.

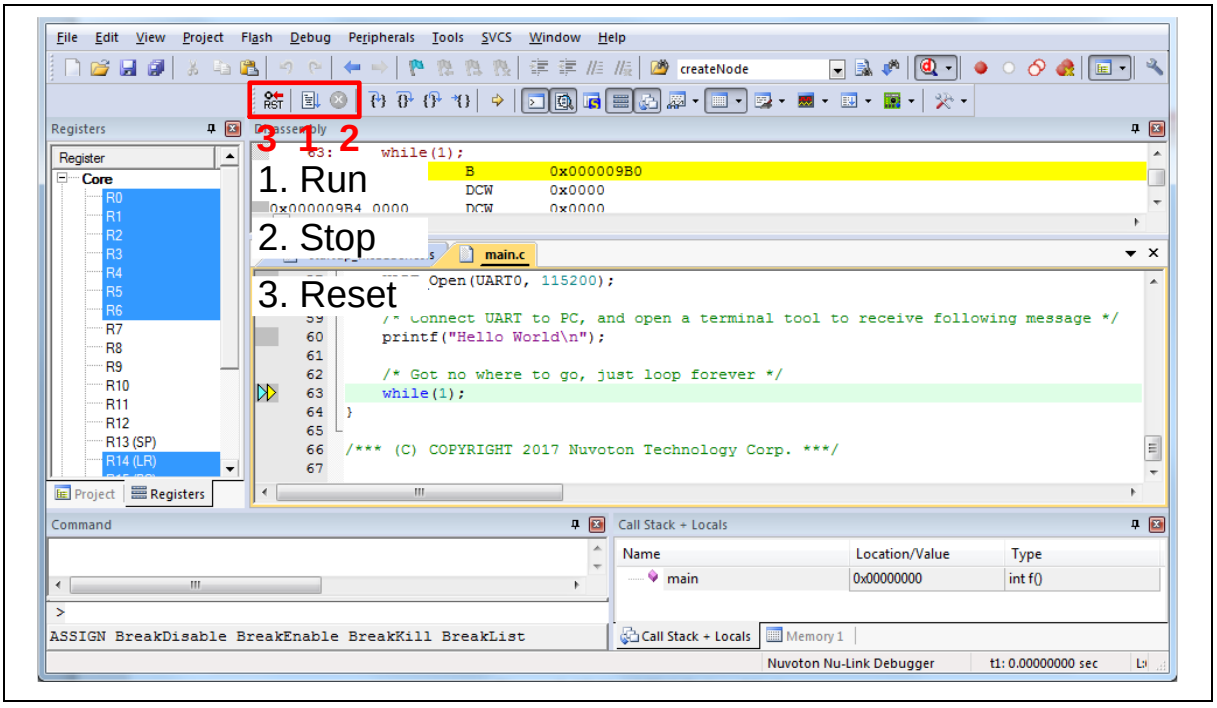


Figure 4-13 Keil MDK Debug Mode

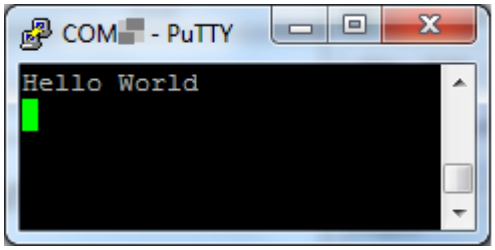


Figure 4-14 Debug Message on Serial Port Terminal Windows

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.

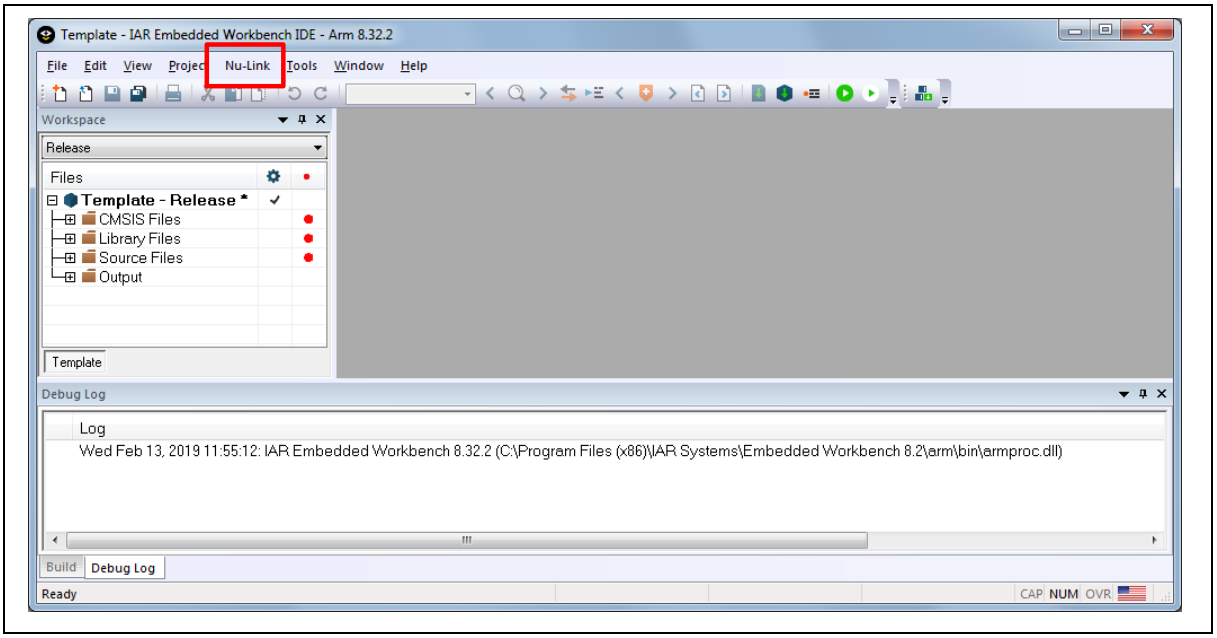


Figure 4-15 IAR EWARM Window

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.

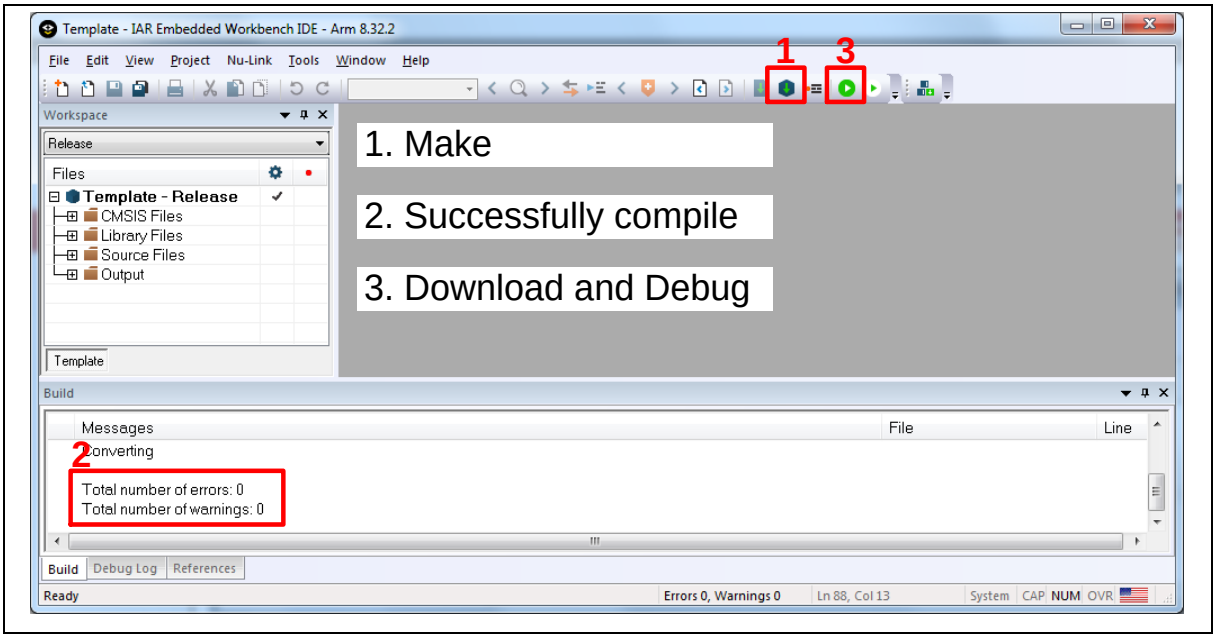


Figure 4-16 Compile and Download the Project

4. 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.

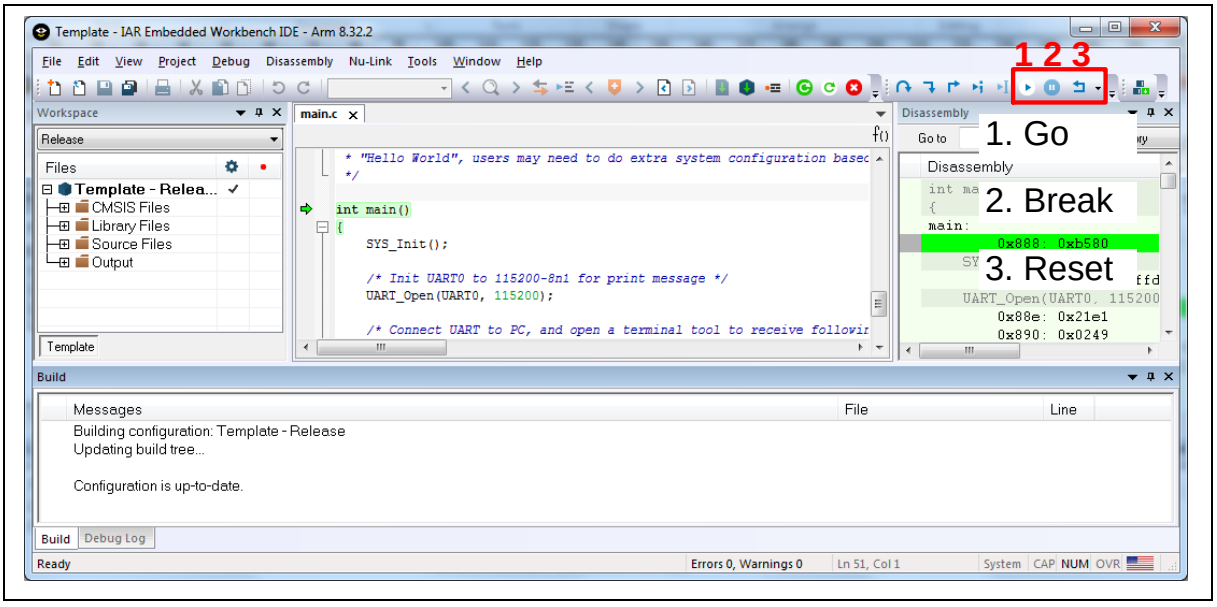


Figure 4-17 IAR EWARM Debug Mode

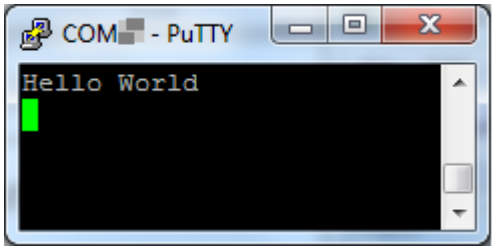


Figure 4-18 Debug Message on Serial Port Terminal Windows

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.

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

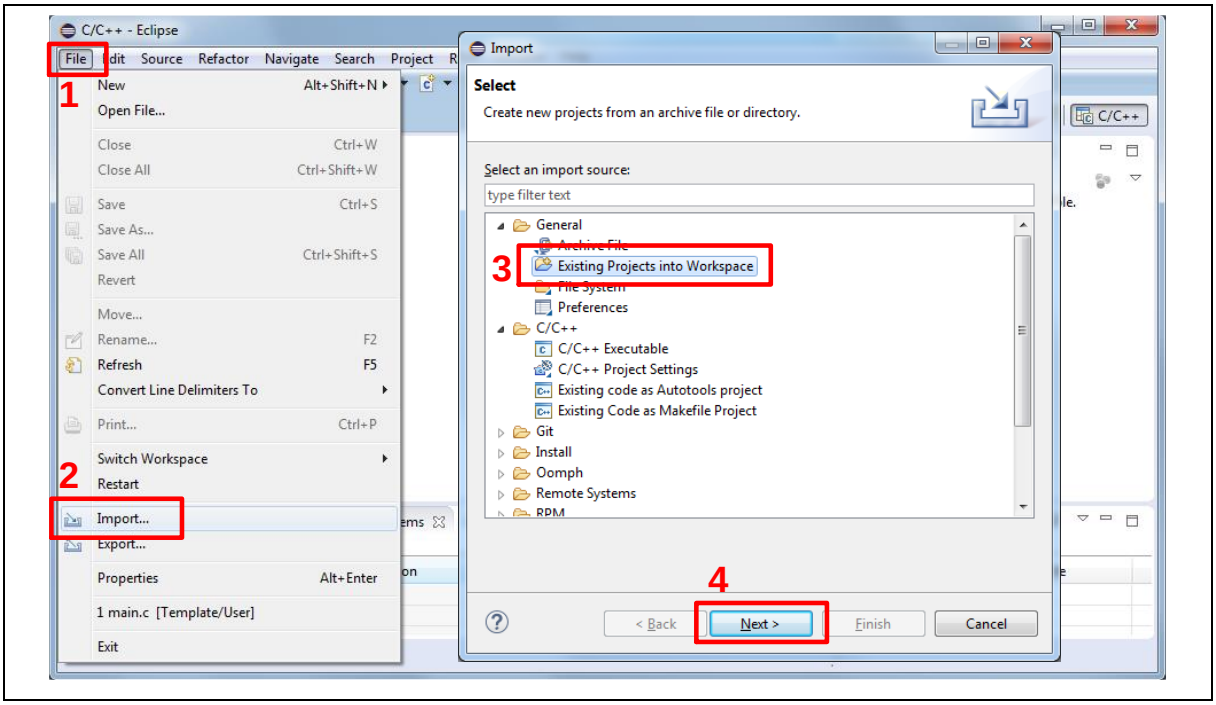


Figure 4-19 Import the Project in NuEclipse

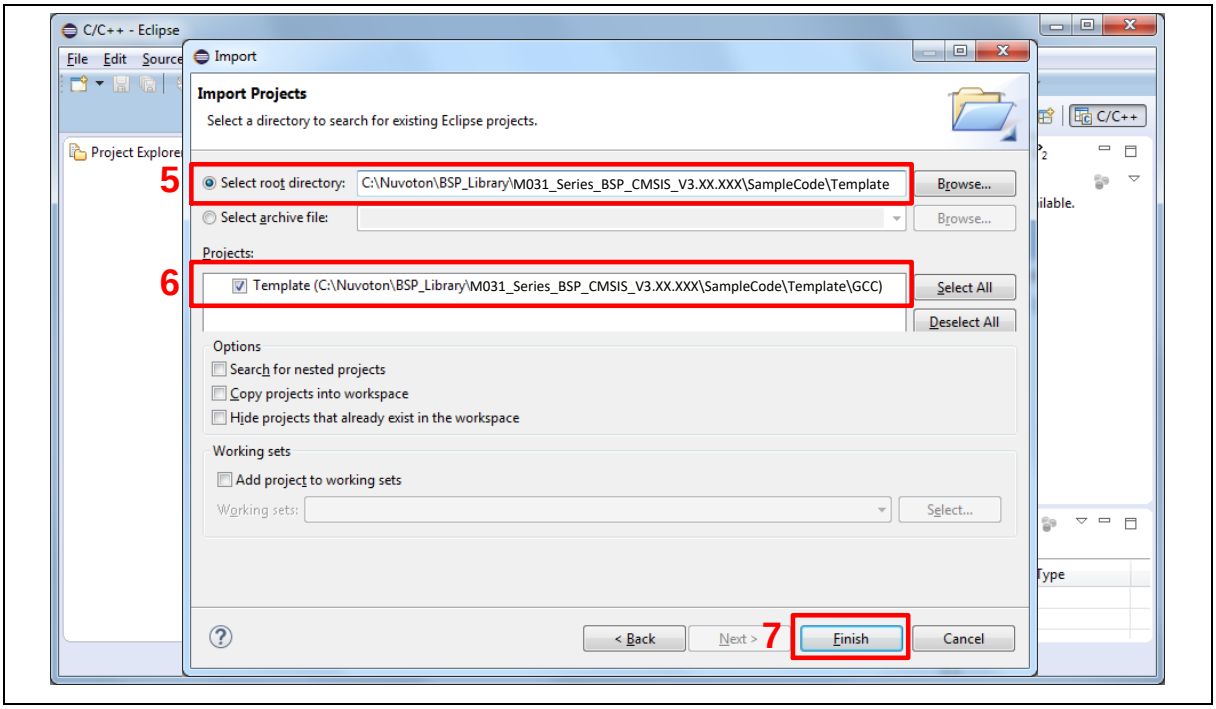


Figure 4-20 Import Projects Windows

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.

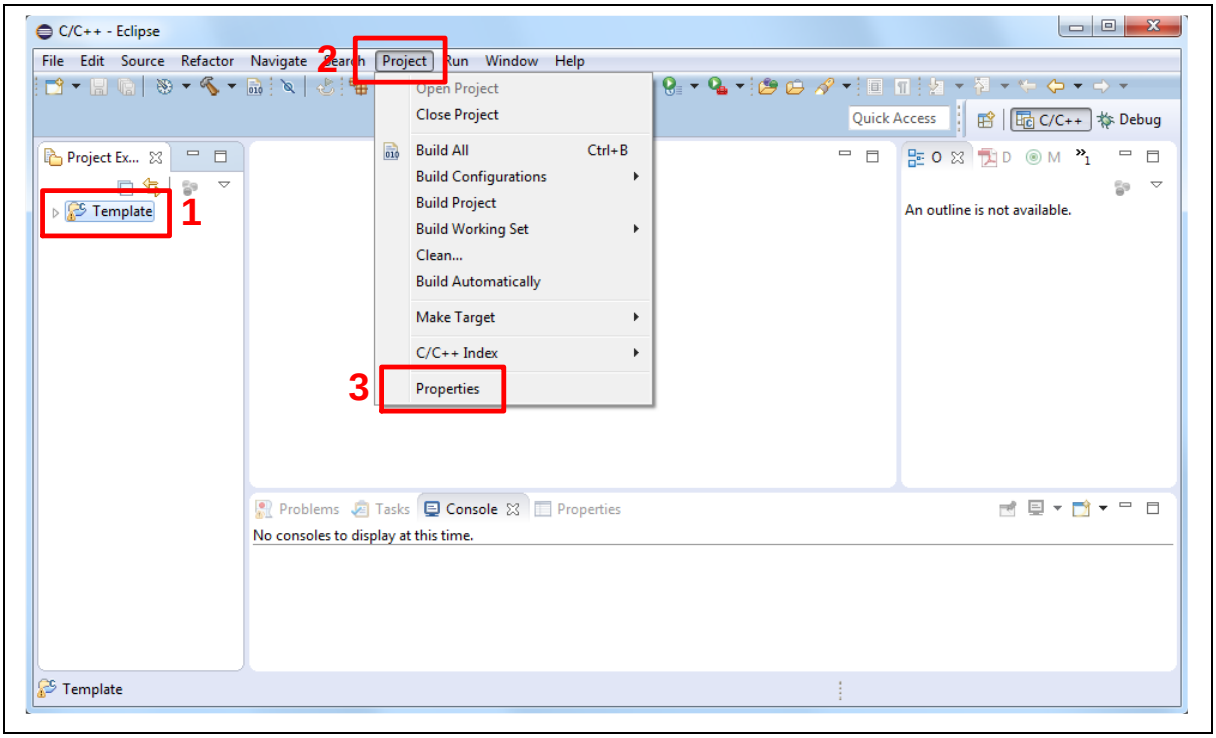


Figure 4-21 Open Project Properties Window

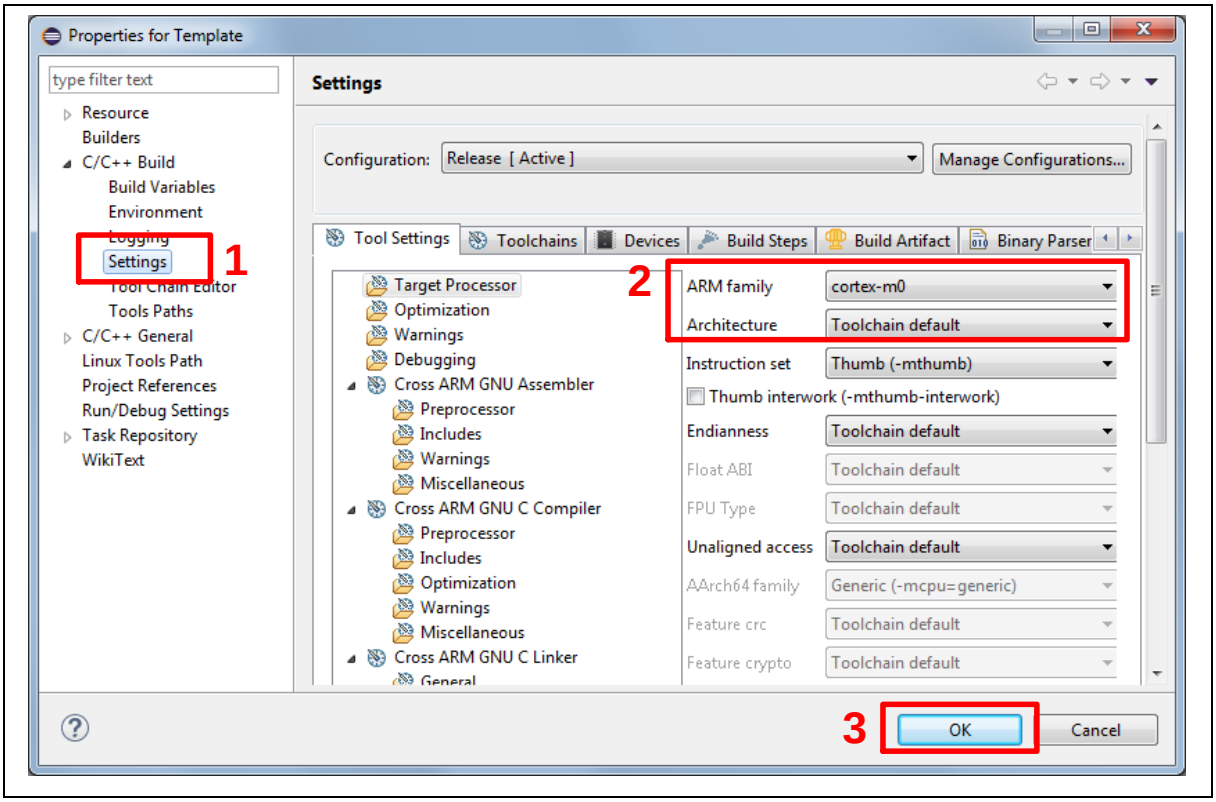


Figure 4-22 Project Properties Settings

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

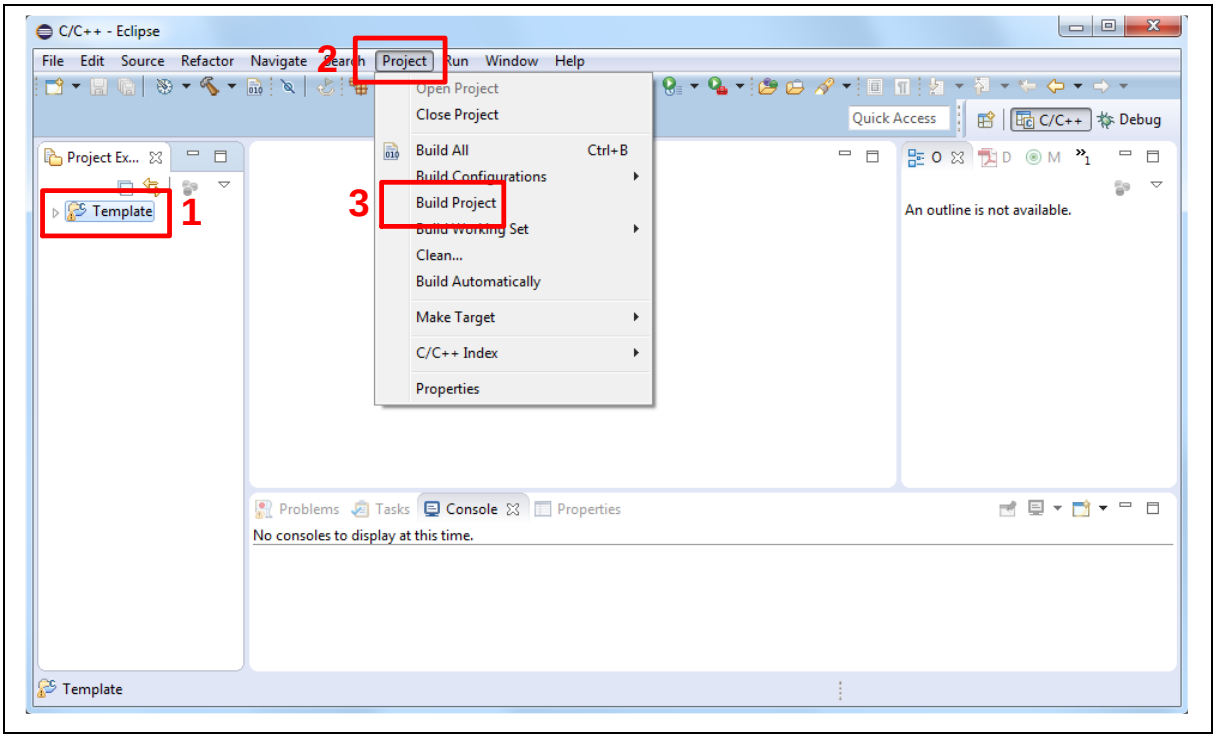


Figure 4-23 Build Project

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.

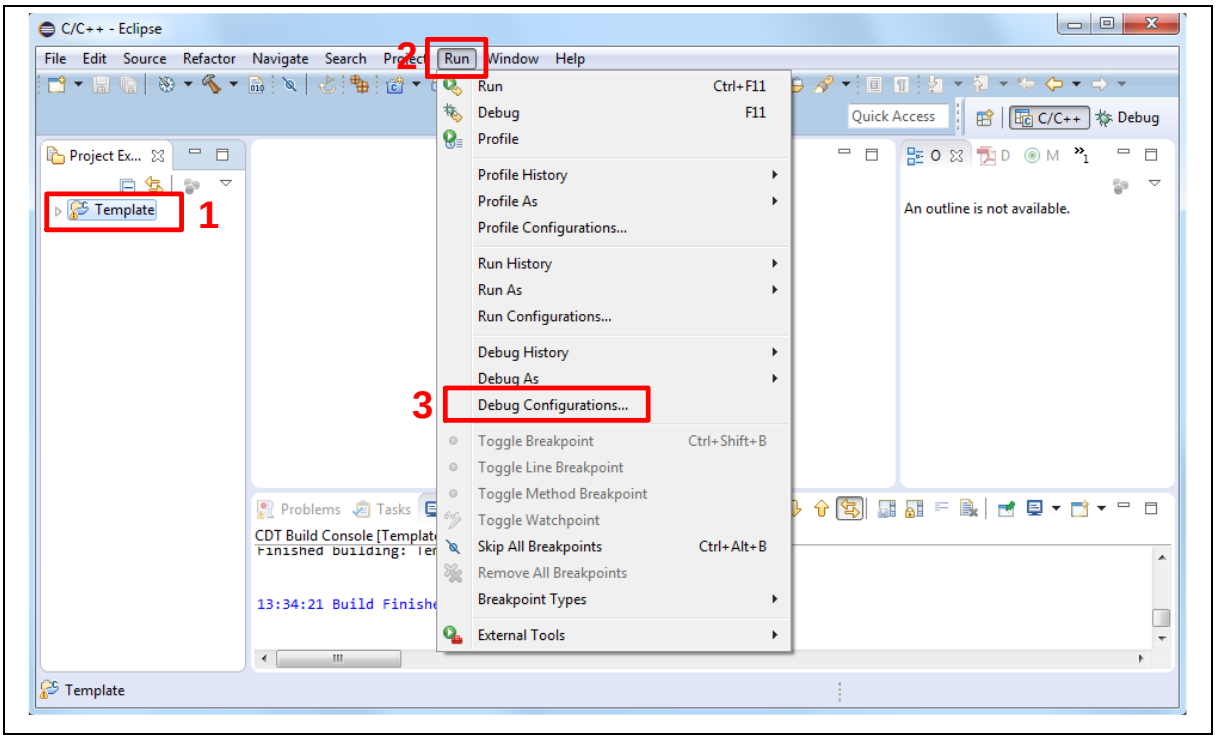
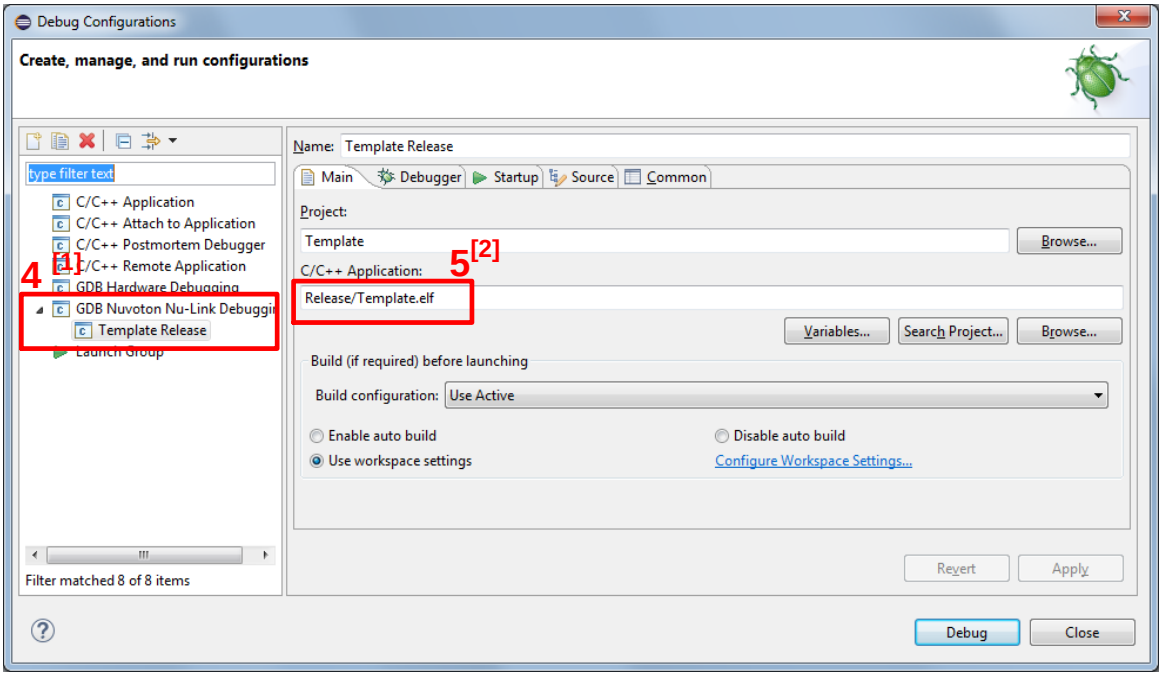


Figure 4-24 Open Debug Configuration



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

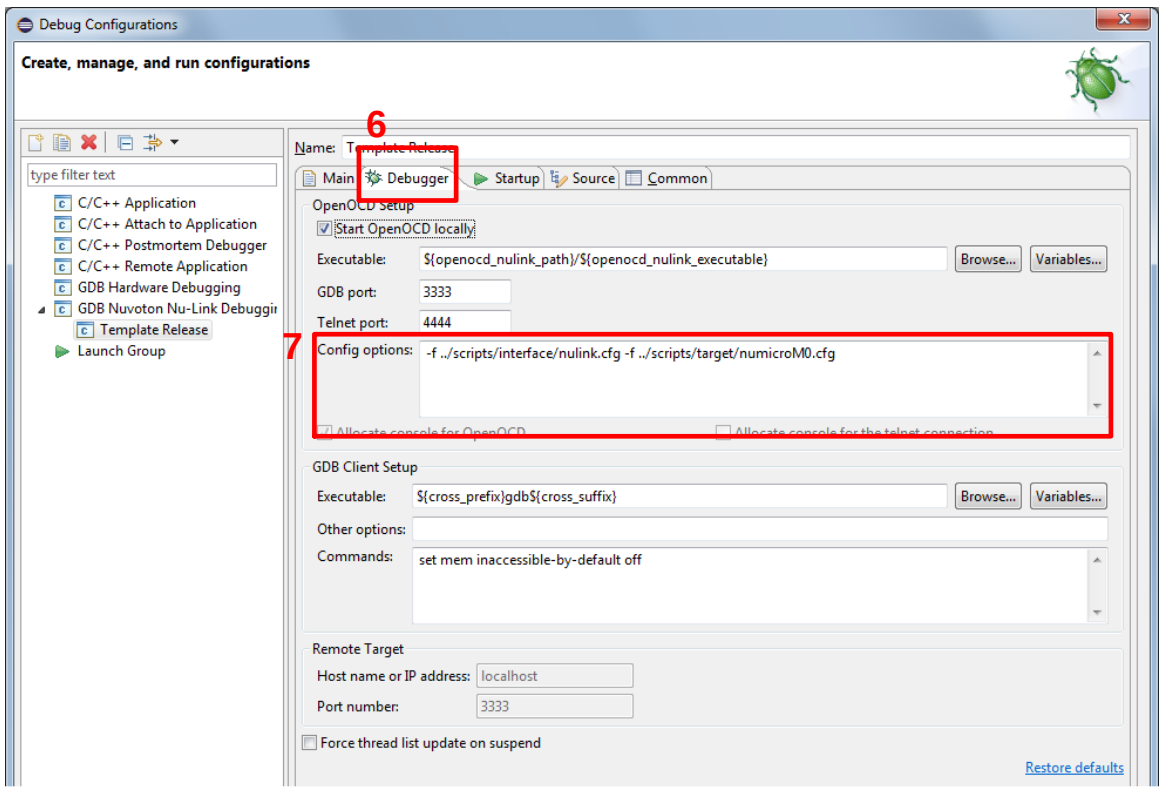
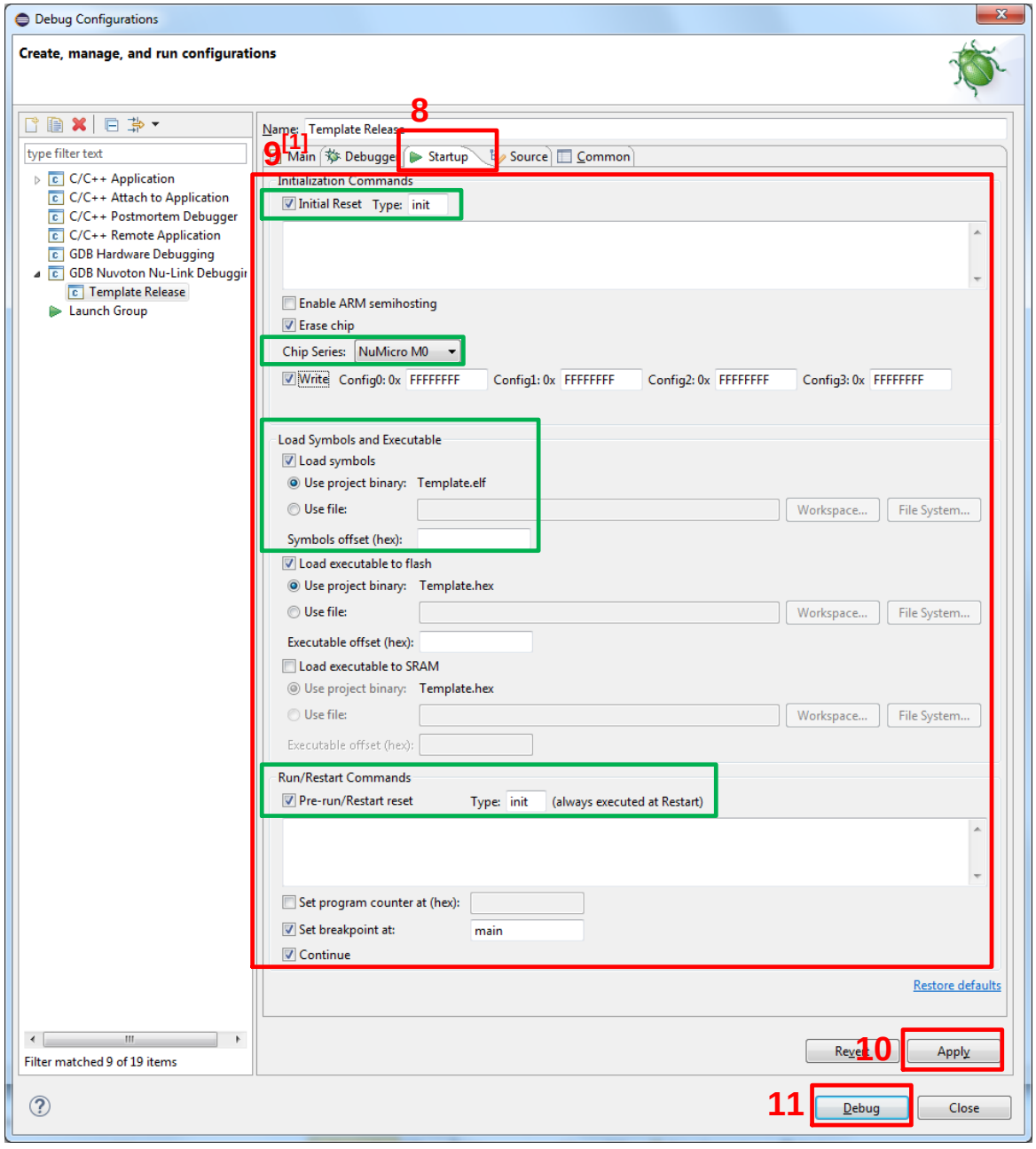


Figure 4-26 Debugger Tab Configuration



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*.

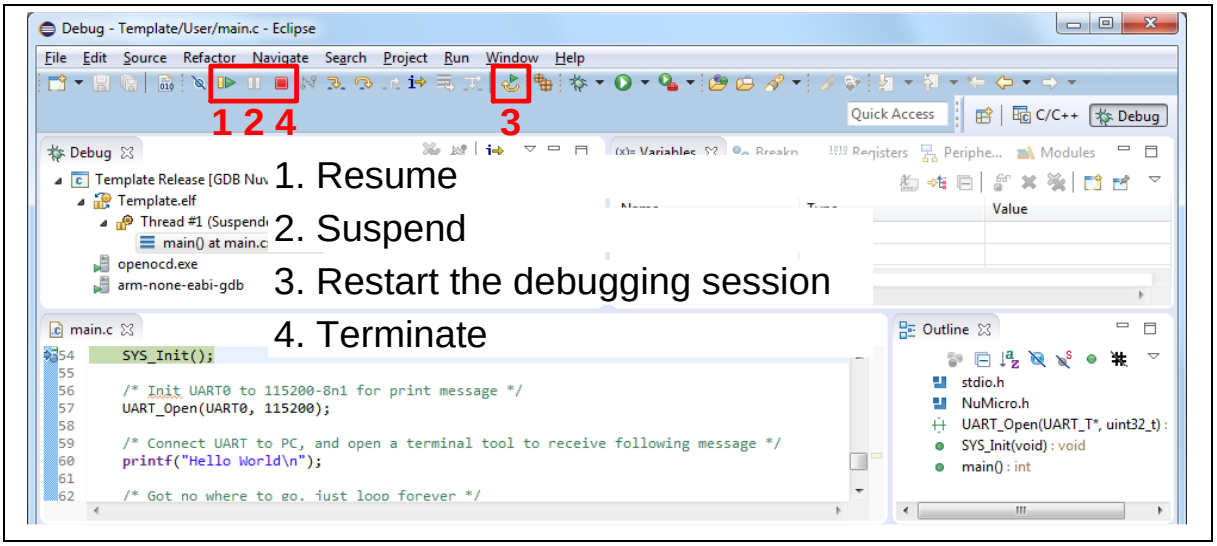


Figure 4-28 NuEclipse Debug Mode

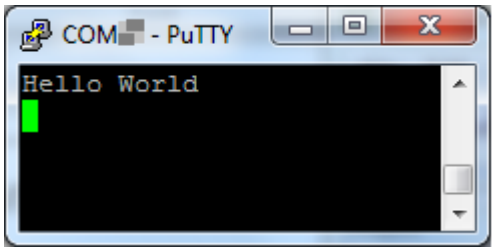


Figure 4-29 Debug Message on Serial Port Terminal Windows

5 NUMAKER-M256SD SCHEMATICS

5.1 Nu-Link2-Me

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

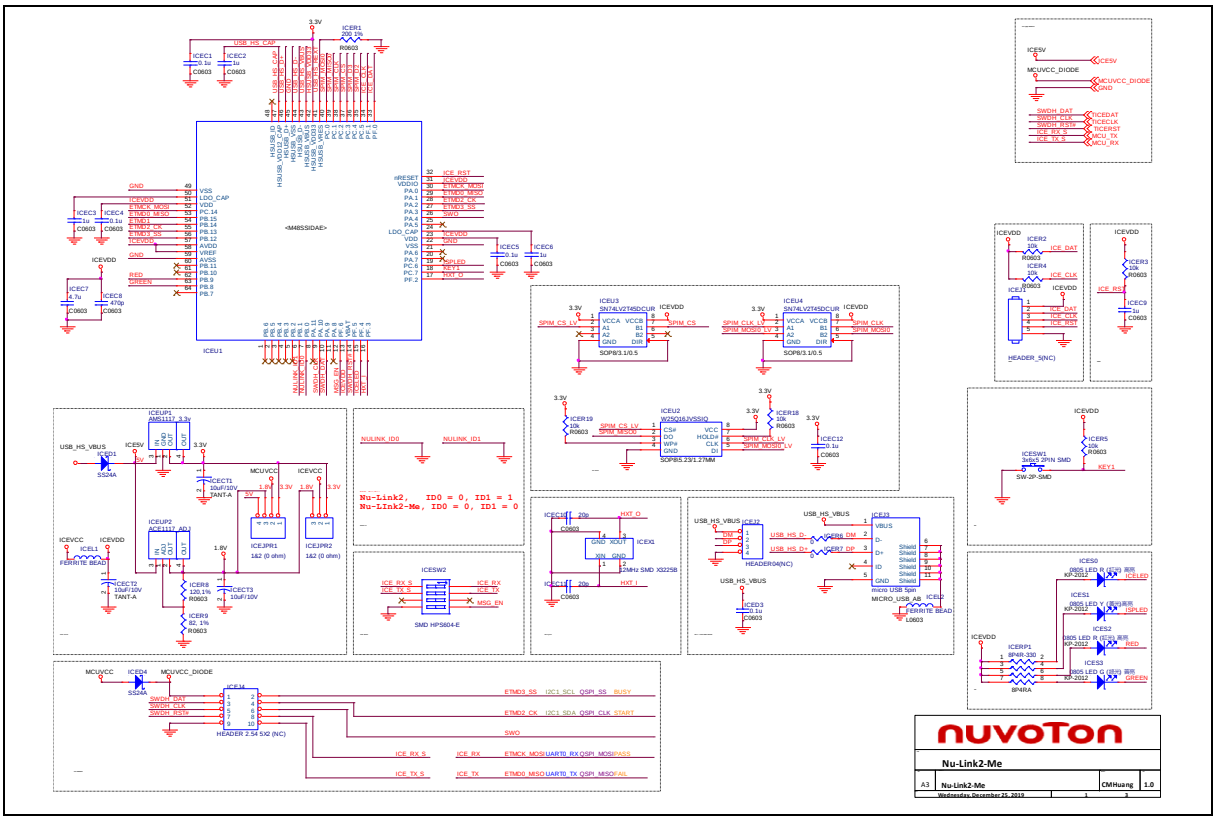


Figure 5-1 Nu-Link2-Me Circuit

5.2 M256SD Target Board

Figure 5-2 shows the M256SD target board circuit.

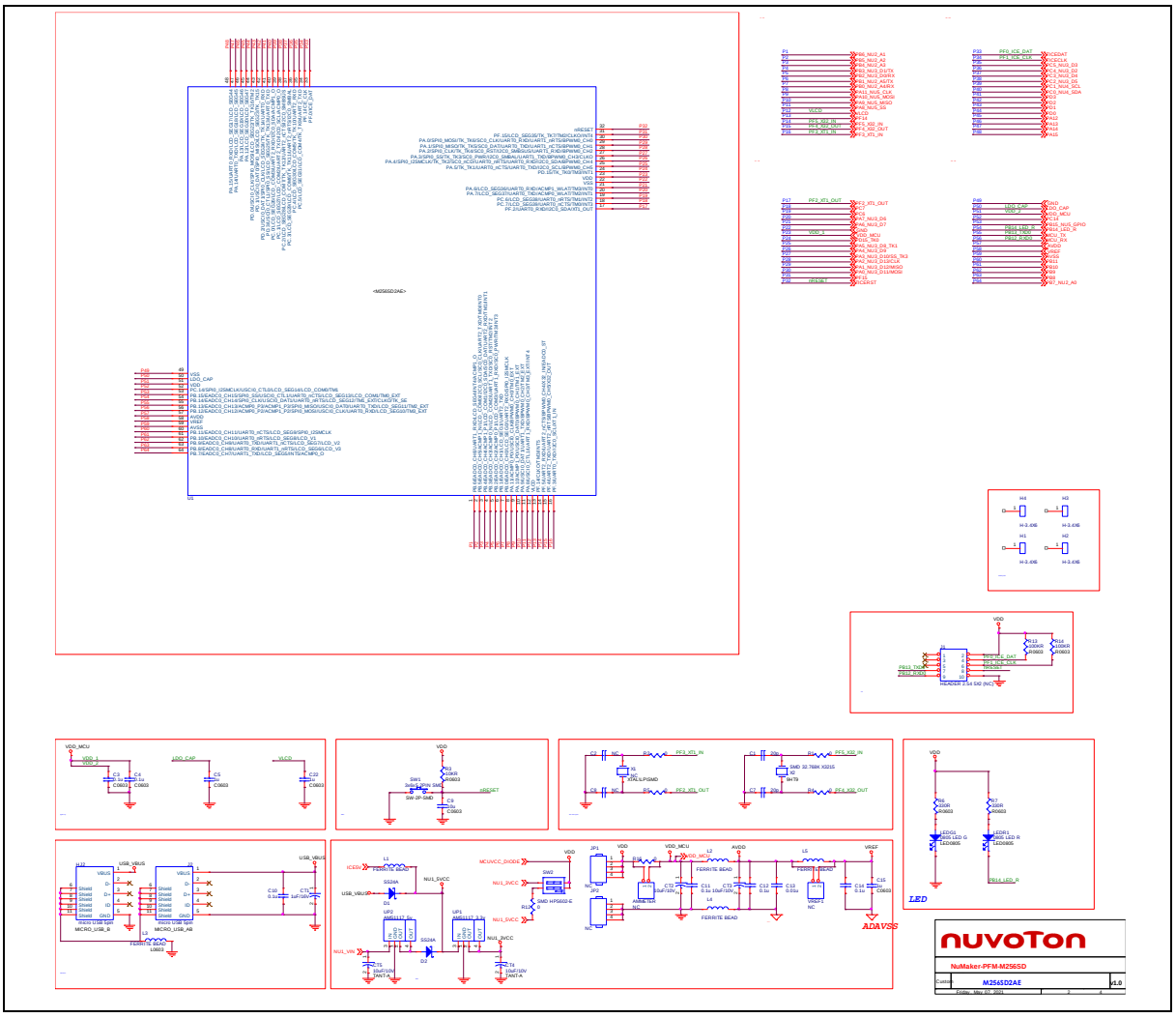


Figure 5-2 M256SD Target Board Circuit

5.3 Extension Connectors

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

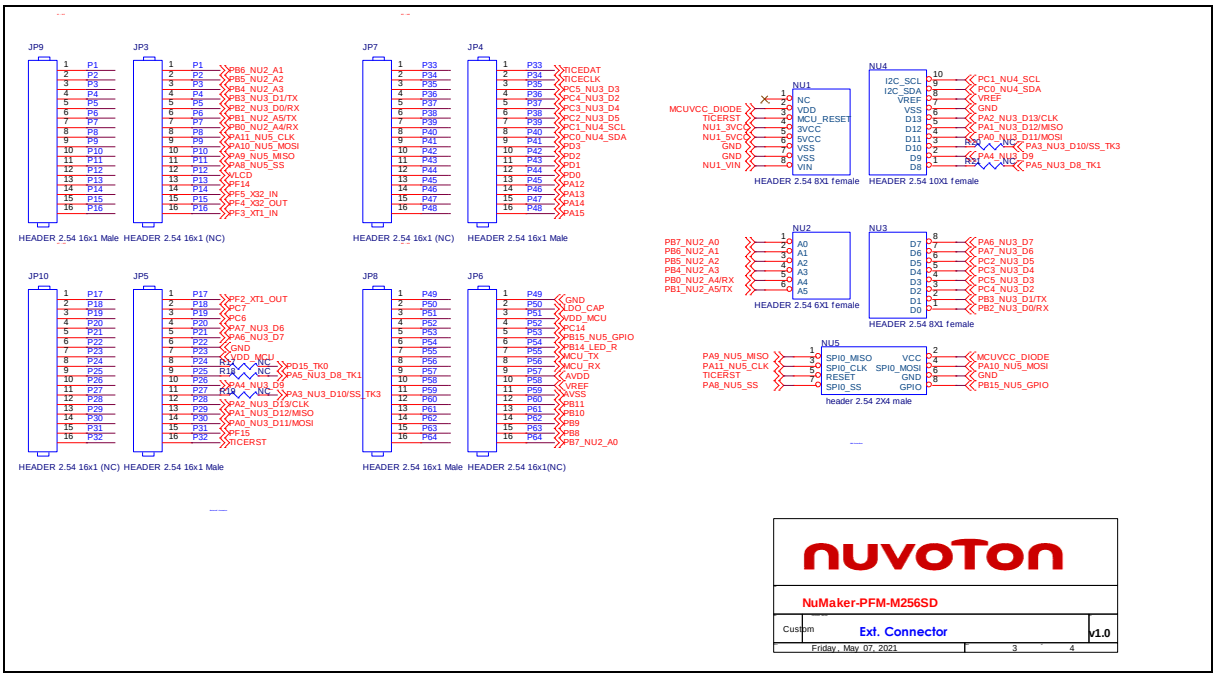


Figure 5-3 Extension Connectors Circuit

5.4 Touch Key

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

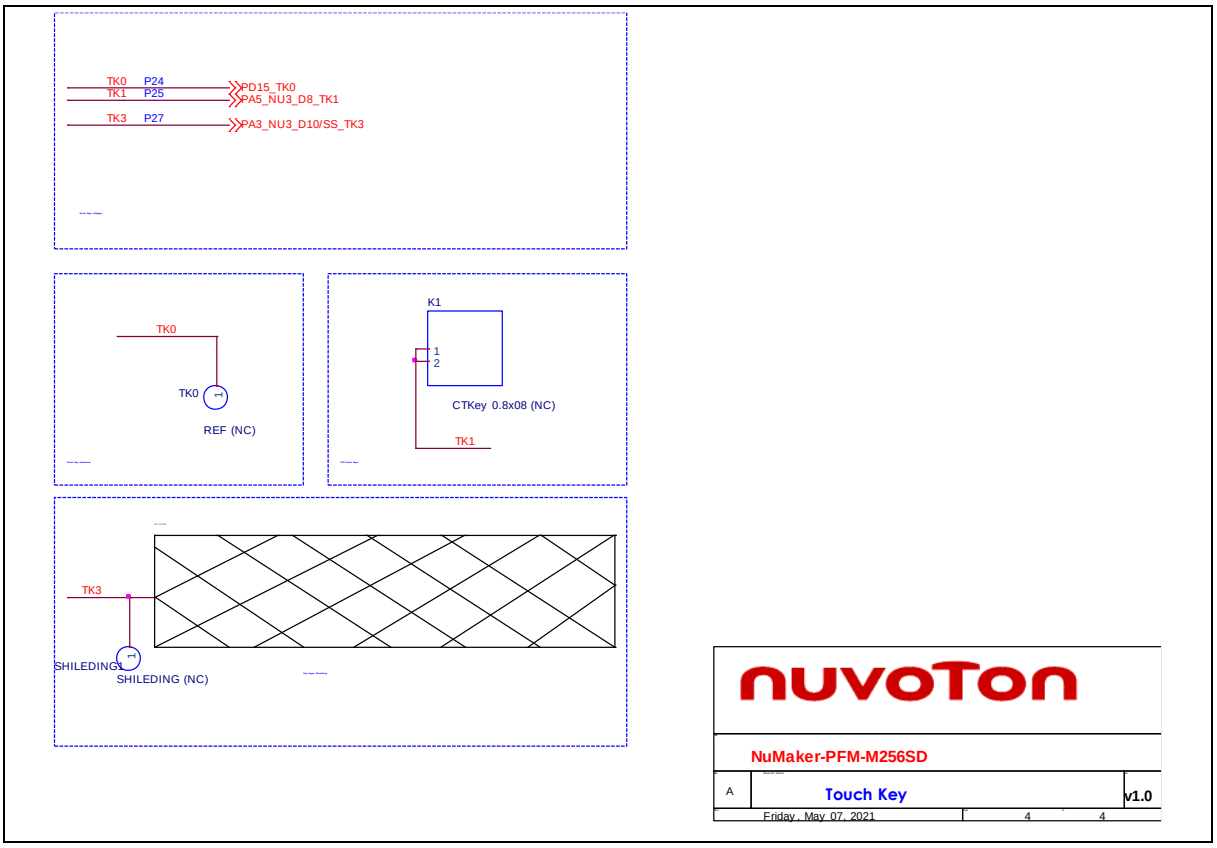


Figure 5-4 Touch Key Circuit

5.5 PCB Placement

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

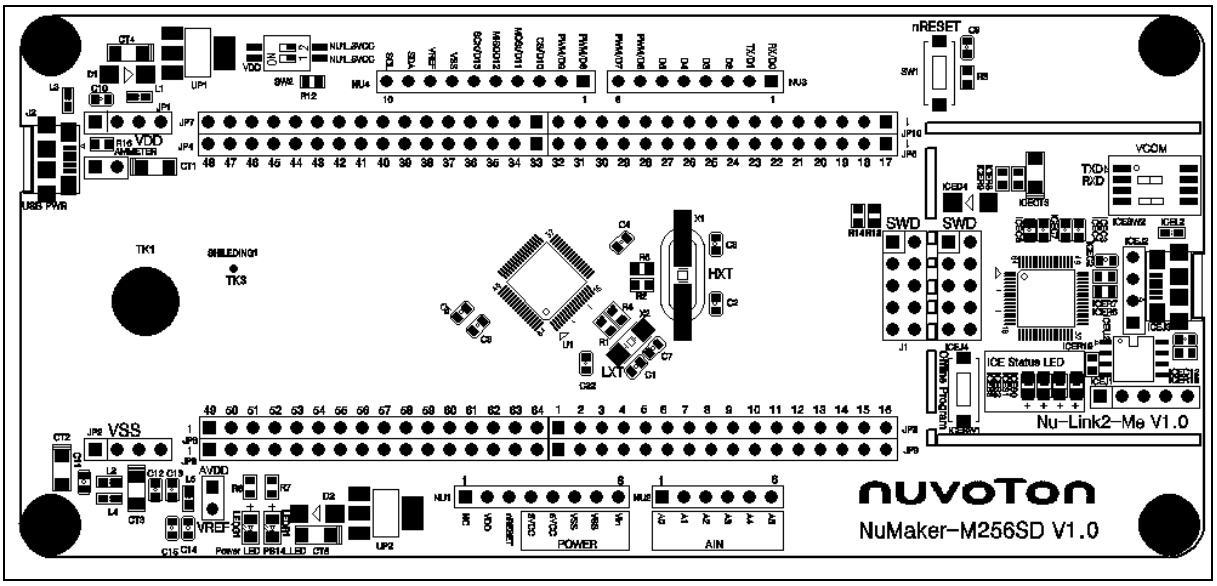


Figure 5-5 Front Placement

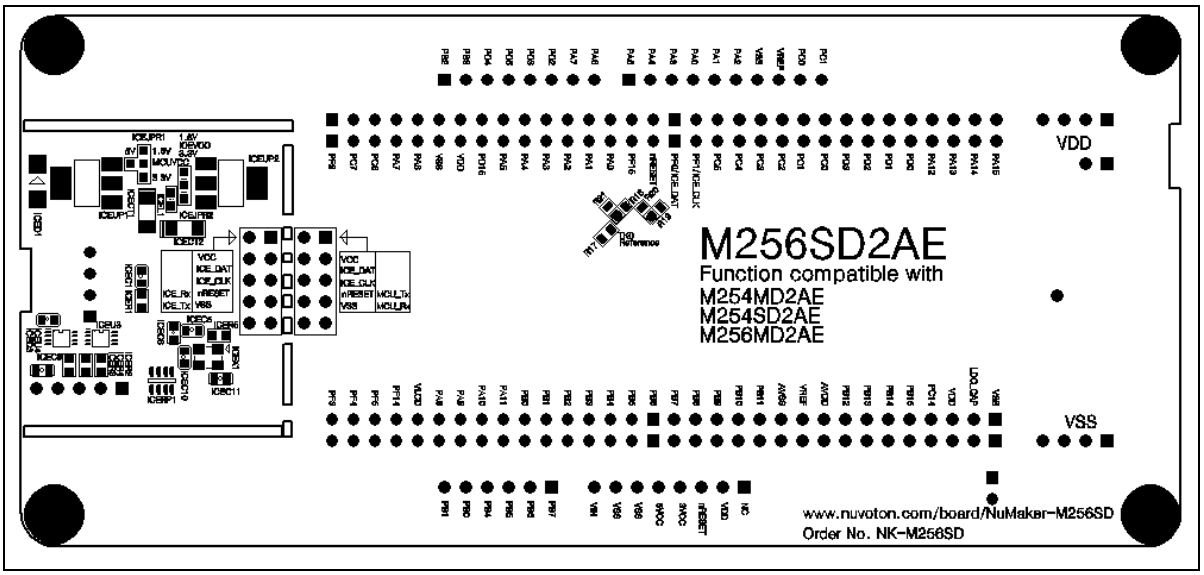


Figure 5-6 Rear Placement

6 REVISION HISTORY

Date	Revision	Description
2022.05.20	1.00	Initial version.

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