NuMicro® Family

Arm® Cortex®-M23-based Microcontroller

NuMaker-M2A23SG

User Manual

Evaluation Board for NuMicro® M2A23 Series

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1 OVERVIEW

The NuMaker-M2A23SG is an evaluation board for Nuvoton NuMicro M2A23SG5AC, M2A23SE5AC, M2A23SD5AC, M2A23LG5AC, M2A23LE5AC, M2A23LD5AC, M2A23YG5AC, M2A23YE5AC and M2A23YD5AC microcontrollers. The NuMaker-M2A23SG consists of two parts: an M2A23 target board and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-M2A23SG is designed for project evaluation, prototype development and validation with power consumption monitoring function.

The M2A23 target board is based on NuMicro M2A23SG5AC. For the development flexibility, the M2A23 target board provides the extension connectors, the Arduino UNO compatible headers and the capability of adopting multiple power supplies. The M2A23 target board also provides CAN and LIN transceiver for relative function development. 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.

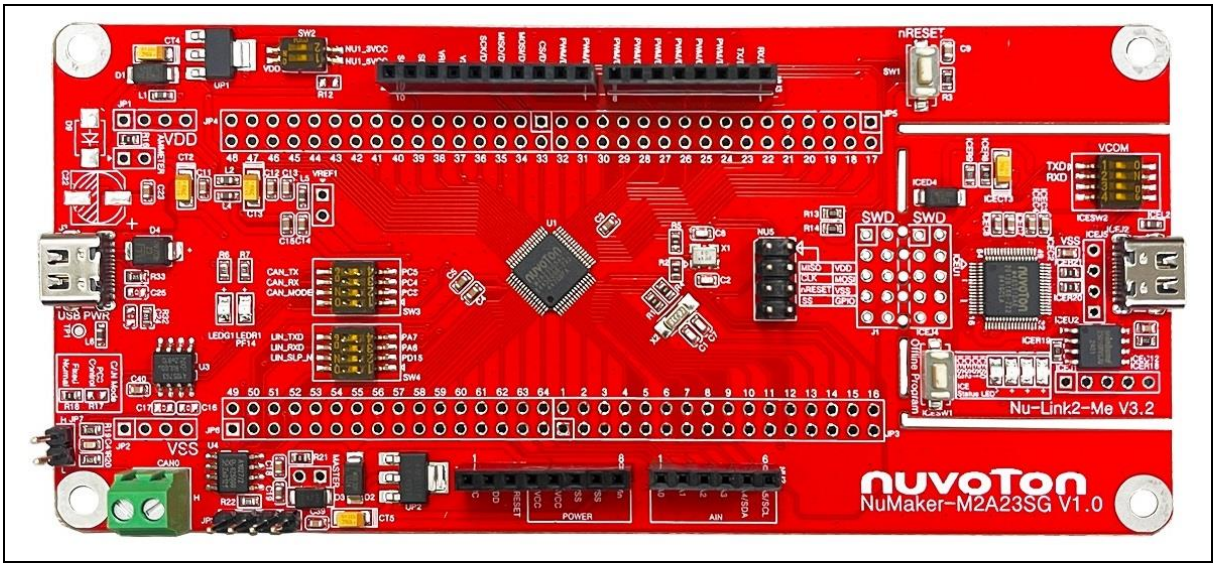


Figure 1-1 NuMaker-M2A23SG Evaluation Board

2 FEATURES

- NuMicro M2A23SG5AC used as main microcontroller with function compatible with:
  - M2A23SG5AC
  - M2A23SE5AC
  - M2A23SD5AC
  - M2A23LG5AC
  - M2A23LE5AC
  - M2A23LD5AC
  - M2A23YG5AC
  - M2A23YE5AC
  - M2A23YD5AC
- M2A23SG5AC full pins 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
  - LIN bus connector JP8_5VCC
  - USB power connector on M2A23 target board
  - ICE USB connector on Nu-Link2-Me
- On-board CAN transceiver and bus connector
- On-board LIN transceiver and bus connector
- 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

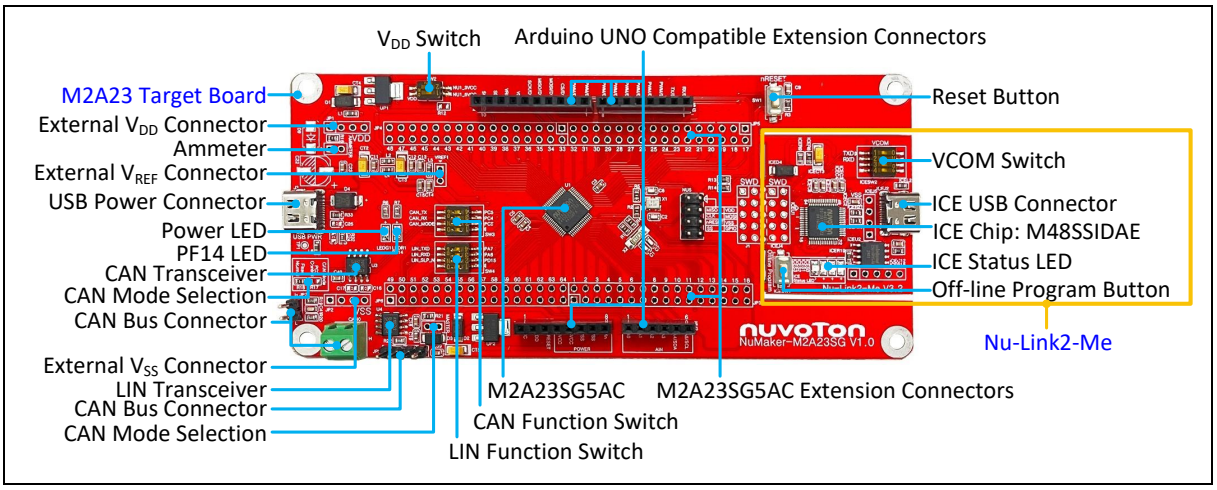


Figure 3-1 Front View of NuMaker-M2A23SG

Figure 3-1 shows the main components and connectors from the front side of NuMaker-M2A23SG. The following lists components and connectors from the front view:

- Target chip: M2A23SG5AC (U1)
- USB PWR Connector (J3)
- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)
- M2A23SG5AC Extension Connectors (JP3, JP4, JP5 and JP6)
- 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 PF14 LED (LEDG1 and LEDR1)
- On-board CAN Transceiver (U3)
- CAN Bus Connector (JP7 and CAN0)
- CAN Function Switch (SW3)
  - Enable PC.4 and PC.5 to CAN transceiver
  - Enable PC.3 to control CAN Mode
- On-board LIN Transceiver (U4)
- LIN Bus Connector (JP8)
- LIN Function Switch (SW4)
  - Enable PA.6 and P7.7 to LIN transceiver
  - Enable PD.15 to control LIN mode

- Nu-Link2-Me
  - VCOM Switch
  - ICE Chip: M48SSIDAE (ICEU1)
  - ICE USB Connector (ICEJ2)
  - ICE Status LED (ICES0, ICES1, ICES2, ICES3)
  - Off-line Program Button (ICESW1)

3.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-M2A23SG.

The following lists components and connectors from the rear view:

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

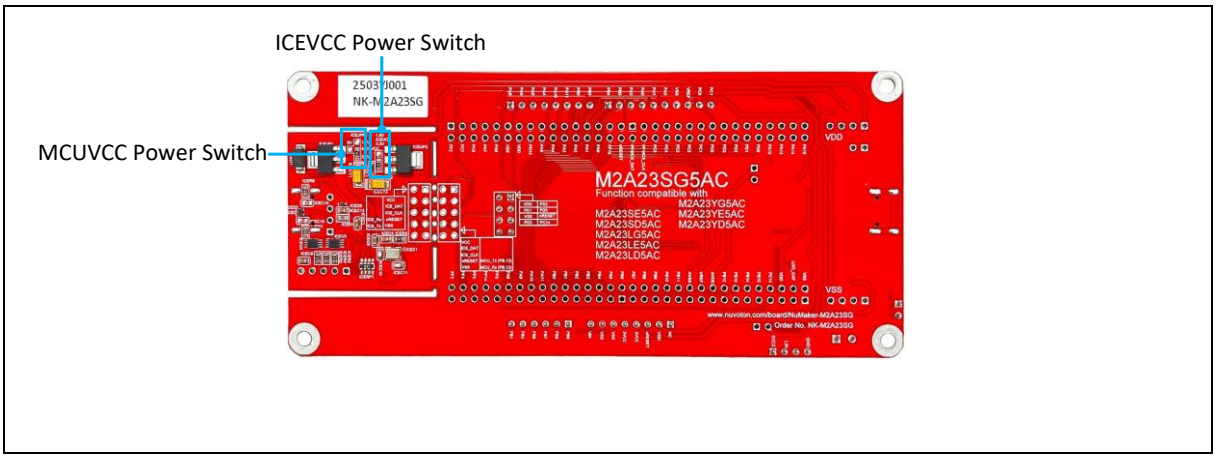


Figure 3-2 Rear View of NuMaker-M2A23SG

3.3 Extension Connectors

Table 3-1 presents the extension connectors.

Connector	Description
JP3, JP4, JP5 and JP6	Full pins extension connectors on the NuMaker-M2A23SG.
NU1, NU2, NU3 and NU4	Arduino UNO compatible pins on the NuMaker-M2A23SG.

Table 3-1 Extension Connectors

3.3.1 Pin Assignment for Extension Connectors

The NuMaker-M2A23SG provides the M2A23SG5AC onboard and extension connectors (JP3, JP4, JP5 and JP6). Figure 3-3 shows the M2A23SG5AC extension connectors.

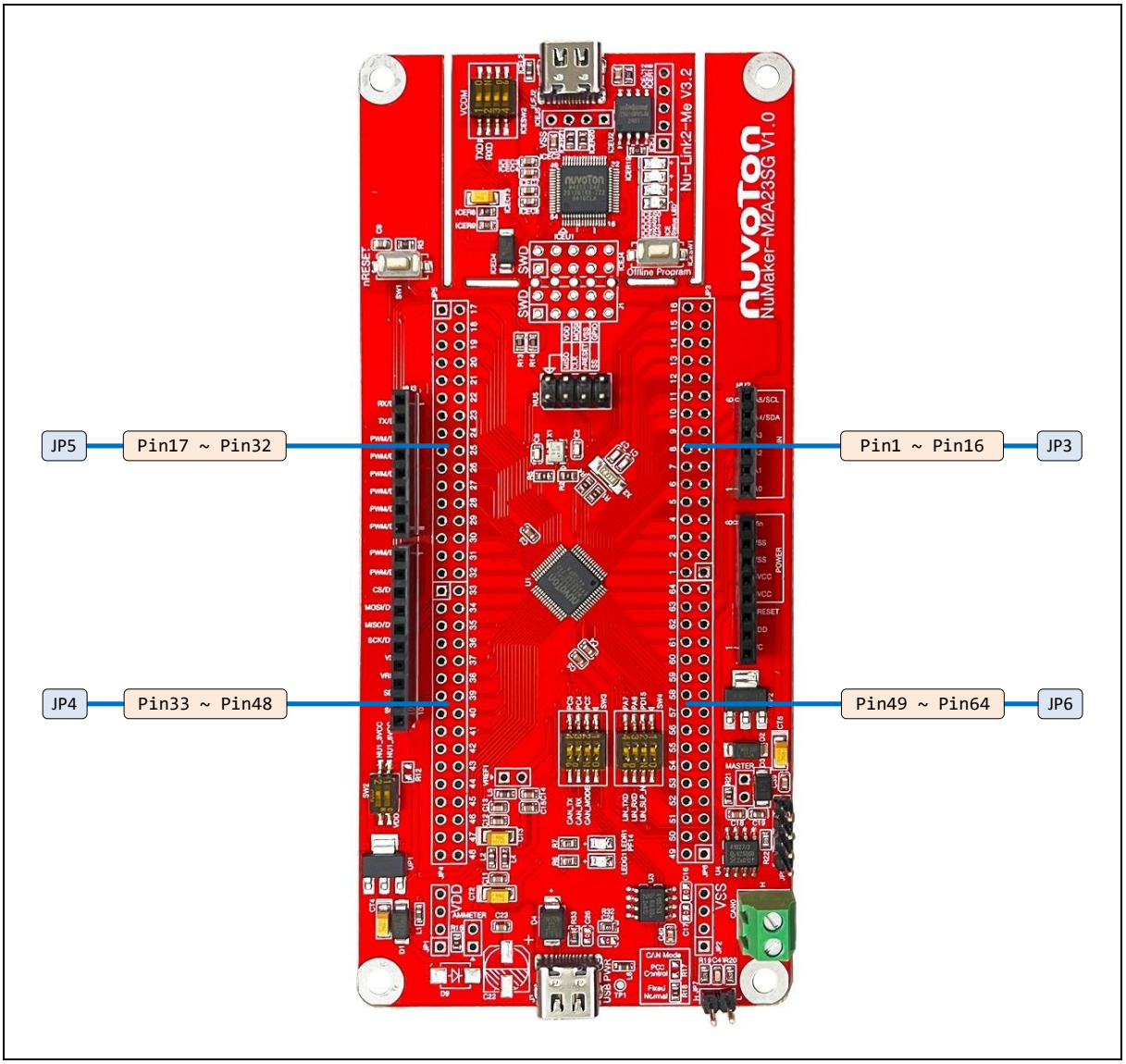


Figure 3-3 M2A23SG5AC Extension Connectors

Header			M2A23SG5AC	
			Pin No.	Function
JP3	JP3.1	JP3.2	1	PB.6 / ADC0_CH6 / UART1_RXD / USCI1_DAT1 / CANFD1_RXD / CANFD0_TXL / ACMP1_O / INT4
	JP3.3	JP3.4	2	PB.5 / ADC0_CH5 / ACMP1_N / I2C0_SCL / USCI1_CTL0 / CANFD0_TXD / CANFD0_TXH / PWM0_CH0 / TM0 / INT0
	JP3.5	JP3.6	3	PB.4 / ADC0_CH4 / ACMP1_P1 / I2C0_SDA / USCI1_CTL1 / CANFD0_RXD / PWM0_CH1 / TM1 / INT1
	JP3.7	JP3.8	4	PB.3 / ADC0_CH3 / ACMP0_N / UART1_TXD / I2C0_SMBAL / USCI1_DAT1 / CANFD1_TXD / CANFD1_TXH / PWM0_CH2 / CANFD1_TXL / TM2 / INT2
	JP3.9	JP3.10	5	PB.2 / ADC0_CH2 / ACMP0_P1 / UART1_RXD / I2C0_SMBSUS / USCI1_DAT0 / CANFD1_RXD / PWM0_CH3 / TM3 / INT3
	JP3.11	JP3.12	6	PB.1 / ADC0_CH1 / USCI1_CLK / CANFD0_TXD / CANFD0_TXH / PWM0_CH4 / PWM0_BRAKE0
	JP3.13	JP3.14	7	PB.0 / ADC0_CH0 / USCI0_CTL0 / CANFD0_RXD / PWM0_CH5 / PWM0_BRAKE1 / CANFD0_TXL
	JP3.15	JP3.16	8	PA.11 / ACMP0_P0 / LLSI0_OUT / USCI0_CLK / BPWM0_CH0 / TM0_EXT
	JP3.17	JP3.18	9	PA.10 / ACMP1_P0 / LLSI1_OUT / USCI0_DAT0 / CANFD1_TXL / BPWM0_CH1 / TM1_EXT
	JP3.19	JP3.20	10	PA.9 / UART1_TXD / USCI0_DAT1 / CANFD1_TXD / CANFD1_TXH / BPWM0_CH2 / TM2_EXT
	JP3.21	JP3.22	11	PA.8 / UART1_RXD / USCI0_CTL1 / CANFD1_RXD / BPWM0_CH3 / TM3_EXT / INT4
	JP3.23	JP3.24	12	PF.6 / SPI0_MOSI / CLKO
	JP3.25	JP3.26	13	PF.14 / TM3 / CLKO
	JP3.27	JP3.28	14	PF.5 / X32_IN / LLSI0_OUT / PWM0_CH0 / BPWM0_CH4 / ADC0_ST
	JP3.29	JP3.30	15	PF.4 / X32_OUT / LLSI1_OUT / CANFD0_TXL / PWM0_CH1 / BPWM0_CH5
	JP3.31	JP3.32	16	PF.3 / UART0_TXD / XT1_IN / I2C0_SCL / CANFD0_TXD / CANFD0_TXH
JP5	JP5.1	JP5.2	17	PF.2 / UART0_RXD / XT1_OUT / I2C0_SDA / CANFD0_RXD
	JP5.3	JP5.4	18	PC.7 / UART0_nCTS / LLSI0_OUT / TM0 / INT3
	JP5.5	JP5.6	19	PC.6 / UART0_nRTS / LLSI1_OUT / TM1 / INT2
	JP5.7	JP5.8	20	PA.7 / UART0_TXD / ACMP0_WLAT / TM2 / INT1
	JP5.9	JP5.10	21	PA.6 / UART0_RXD / ACMP1_WLAT / TM3 / INT0
	JP5.11	JP5.12	22	V_{SS}
	JP5.13	JP5.14	23	V_{DD}
	JP5.15	JP5.16	24	PD.15 / CANFD0_TXL / TM3 / INT1
	JP5.17	JP5.18	25	PA.5 / UART0_nCTS / UART0_TXD / I2C0_SCL / PWM0_CH0 / BPWM0_CH5
	JP5.19	JP5.20	26	PA.4 / UART0_nRTS / UART0_RXD / I2C0_SDA / CANFD0_TXD / CANFD0_TXH / PWM0_CH1 / BPWM0_CH4 / CANFD1_TXL
	JP5.21	JP5.22	27	PA.3 / UART1_TXD / SPI0_SS / I2C0_SMBAL / CANFD0_RXD / PWM0_CH2 / BPWM0_CH3 / CLKO
	JP5.23	JP5.24	28	PA.2 / UART1_RXD / SPI0_CLK / I2C0_SMBSUS / CANFD1_RXD / PWM0_CH3 / BPWM0_CH2 / CANFD1_TXL
	JP5.25	JP5.26	29	PA.1 / UART1_nCTS / UART0_TXD / SPI0_MISO / LLSI0_OUT / CANFD1_TXD / CANFD1_TXH / PWM0_CH4 / BPWM0_CH1
	JP5.27	JP5.28	30	PA.0 / UART1_nRTS / UART0_RXD / SPI0_MOSI / LLSI1_OUT / CANFD1_RXD / PWM0_CH5 / BPWM0_CH0
	JP5.29	JP5.30	31	PF.15 / CANFD2_TXL / CLKO / INT4
	JP5.31	JP5.32	32	nRESET
JP4	JP4.1	JP4.2	33	PF.0 / UART1_TXD / UART0_TXD / CANFD2_TXD / CANFD2_TXH / ICE_DAT

	JP4.3	JP4.4	34	PF.1 / UART1_RXD / UART0_RXD / CANFD2_RXD / ICE_CLK
	JP4.5	JP4.6	35	PC.5 / LLSI0_OUT / CANFD0_TXD
	JP4.7	JP4.8	36	PC.4 / LLSI1_OUT / CANFD0_RXD / CANFD1_RXD
	JP4.9	JP4.10	37	PC.3 / I2C0_SMBAL / CANFD1_TXD
	JP4.11	JP4.12	38	PC.2 / I2C0_SMBSUS / CANFD2_TXL
	JP4.13	JP4.14	39	PC.1 / I2C0_SCL / CANFD2_TXD / CANFD2_TXH / ACMP0_O / ADC0_ST
	JP4.15	JP4.16	40	PC.0 / I2C0_SDA / USCI0_CTL0 / CANFD2_RXD / ACMP1_O
	JP4.17	JP4.18	41	PD.3 / UART0_TXD / SPI0_SS / USCI0_CTL1
	JP4.19	JP4.20	42	PD.2 / UART0_RXD / SPI0_CLK / USCI0_DAT1
	JP4.21	JP4.22	43	PD.1 / SPI0_MISO / USCI0_DAT0
	JP4.23	JP4.24	44	PD.0 / SPI0_MOSI / USCI0_CLK / CANFD1_TXL / TM2
	JP4.25	JP4.26	45	PA.12 / SPI0_SS / I2C0_SMBAL / CANFD1_RXD / CANFD1_TXH
	JP4.27	JP4.28	46	PA.13 / SPI0_CLK / I2C0_SMBSUS / CANFD1_TXD / CANFD0_TXL
	JP4.29	JP4.30	47	PA.14 / UART0_TXD / SPI0_MISO / LLSI0_OUT / CANFD0_TXD / CANFD0_TXH / ACMP0_WLAT
	JP4.15	JP4.32	48	PA.15 / UART0_RXD / SPI0_MOSI / LLSI1_OUT / CANFD0_RXD / CANFD2_TXL / ACMP1_WLAT
JP6	JP6.1	JP6.2	49	V_{SS}
	JP6.3	JP6.4	50	LDO_CAP
	JP6.5	JP6.6	51	V_{DD}
	JP6.7	JP6.8	52	PC.14 / USCI0_CTL0 / CANFD0_TXL / TM1
	JP6.9	JP6.10	53	PB.15 / ADC0_CH15 / UART0_nCTS / SPI0_SS / LLSI0_OUT / USCI0_CTL1 / CANFD2_TXD / CANFD2_TXH / TM0_EXT
	JP6.11	JP6.12	54	PB.14 / ADC0_CH14 / UART0_nRTS / SPI0_CLK / LLSI1_OUT / USCI0_DAT1 / CANFD2_RXD / CANFD0_TXL / TM1_EXT / CLKO
	JP6.13	JP6.14	55	PB.13 / ADC0_CH13 / ACMP0_P3 / ACMP1_P3 / UART0_TXD / SPI0_MISO / I2C0_SCL / USCI0_DAT0 / CANFD0_TXD / CANFD0_TXH / TM2_EXT
	JP6.15	JP6.16	56	PB.12 / ADC0_CH12 / ACMP0_P2 / ACMP1_P2 / UART0_RXD / SPI0_MOSI / I2C0_SDA / USCI0_CLK / CANFD0_RXD / TM3_EXT
	JP6.17	JP6.18	57	AV_{DD}
	JP6.19	JP6.20	58	V_{REF}
	JP6.21	JP6.22	59	AV_{SS}
	JP6.23	JP6.24	60	PB.11 / ADC0_CH11 / UART0_nCTS / CANFD0_TXD / CANFD0_TXH
	JP6.25	JP6.26	61	PB.10 / ADC0_CH10 / UART0_nRTS / USCI1_CTL0 / CANFD0_RXD / CANFD2_TXL
	JP6.27	JP6.28	62	PB.9 / ADC0_CH9 / UART0_TXD / UART1_nCTS / USCI1_CTL1 / CANFD2_TXD / CANFD2_TXH
	JP6.29	JP6.30	63	PB.8 / ADC0_CH8 / UART0_RXD / UART1_nRTS / USCI1_CLK / CANFD2_RXD / CANFD1_TXL
	JP6.15	JP6.32	64	PB.7 / ADC0_CH7 / UART1_TXD / USCI1_DAT0 / CANFD1_TXD / CANFD1_TXH / ACMP0_O / INT5

Table 3-2 M2A23SG5AC Full-pin Extension Connectors and GPIO Function List

3.3.2 Arduino UNO Compatible Extension Connectors

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

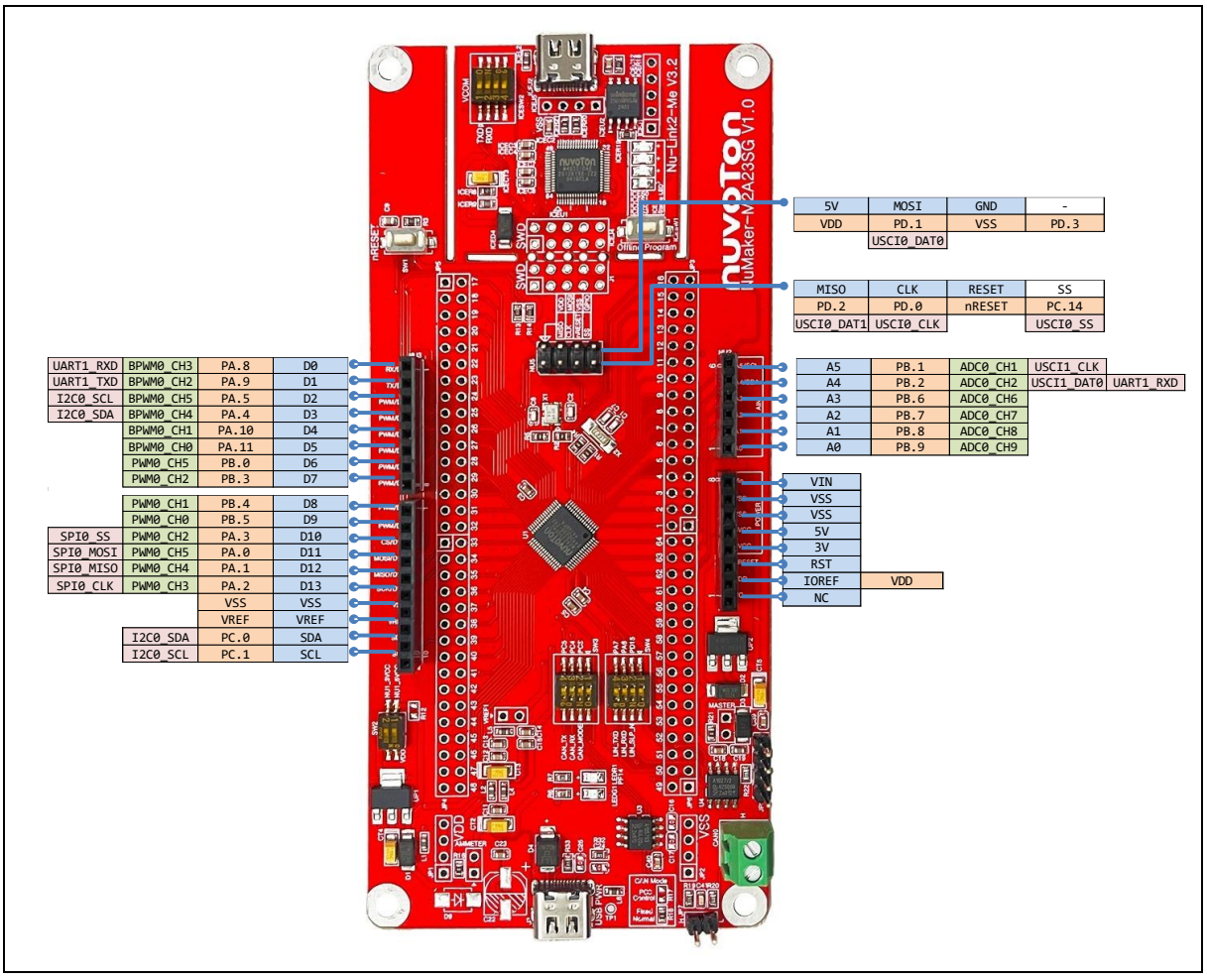


Figure 3-4 Arduino UNO Compatible Extension Connectors

Header		NuMaker-M2A23SG		Header		NuMaker-M2A23SG	
		Compatible to Arduino UNO	GPIO Pin of M2A23SG5AC			Compatible to Arduino UNO	GPIO Pin of M2A23SG5AC
NU3	NU3.1	D0	PA.8	NU2	NU2.6	A5	PB.1
	NU3.2	D1	PA.9		NU2.5	A4	PB.2
	NU3.3	D2	PA.5		NU2.4	A3	PB.6
	NU3.4	D3	PA.4		NU2.3	A2	PB.7
	NU3.5	D4	PA.10		NU2.2	A1	PB.8
	NU3.6	D5	PA.11		NU2.1	A0	PB.9
	NU3.7	D6	PB.0	NU1	NU1.8	VIN	-
	NU3.8	D7	PB.3		NU1.7	VSS	V_{SS}
NU4	NU4.1	D8	PB.4		NU1.6	VSS	V_{SS}
	NU4.2	D9	PB.5		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	IOREF	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 3-3 Arduino UNO Extension Connectors and M2A23SG5AC Mapping GPIO List

3.4 Power Supply Configuration

The NuMaker-M2A23SG is able to adopt multiple power supplies. External power sources include NU1 Vin (7V to 12V), V_{DD} (depending on the target chip operating voltage), LIN bus through connector JP8, and PC through USB connector. By using switches and voltage regulator, multiple power domains can be created on the NuMaker-M2A23SG.

3.4.1 VIN Power Source

Table 3-4 presents the Vin power source.

Connector	Net Name in Schematic	Description
NU1 pin8	NU1_VIN	Board external power source, with voltage range from 7V to 12V. The voltage regulator UP2 converts the NU1 pin8 input voltage to 5V and supplies it to NU1_5VCC.

Table 3-4 Vin Power Source

3.4.2 5V Power Sources

Table 3-5 presents the 5V power sources.

Connector	Net Name in Schematic	Description
ICEJ2	USB_HS_VBUS	ICE USB connector supplies 5V power from PC to M2A23 target board and Nu-Link2-Me.
J3	USB_VBUS	USB connector on NuMaker-M2A23SG supplies 5V power from PC to M2A23 target board and Nu-Link2-Me. **Note:** If Nu-Link2-Me is detached, user should use J3 or JP8 to provide power to CAN and LIN transceiver.
NU1 pin5	NU1_5VCC	ICEJ2, J3 or NU1 pin8 supplies 5V power to NU1 pin5. NU1 pin5 supplies 5V power to target chip or Arduino adapter board.
JP8	JP8_5VCC	JP8 on NuMaker-M2A23SG supplies 5V power from LIN bus to M2A23 platform and Nu-Link2-Me. **Note:** If Nu-Link2-Me is detached, user should use J3 or JP8 to provide power to CAN and LIN transceiver.

Table 3-5 5V Power Sources

3.4.3 3.3V Power Sources

Table 3-6 presents the 3.3V power sources.

Voltage Regulator	5V Source	Description
ICEUP1	USB_HS_VBUS	ICEUP1 converts USB_HS_VBUS to 3.3V and supplies 3.3V to M2A23 target board or ICE chip.
UP1	USB_VBUS	UP1 converts USB_VBUS to 3.3V and supplies 3.3V to M2A23 target board.
UP1	NU1_5VCC	UP1 converts NU1_5VCC to 3.3V and supplies 3.3V to M2A23 target board.
UP1	JP8_5VCC	UP1 converts JP8_5VCC to 3.3V and supplies 3.3V to M2A23 target board.

Table 3-6 3.3V Power Sources

3.4.4 1.8V Power Sources

Table 3-7 presents the 1.8V power source.

Voltage Regular	5V Source	Description
ICEUP2	USB_HS_VBUS	ICEUP2 converts USB_HS_VBUS to 1.8V and supplies 1.8V to M2A23 target board or ICE chip.

Table 3-7 1.8V Power Sources

3.4.5 Power Connectors

Table 3-8 presents the power connectors.

Connector	Description
JP1	V_{DD} connector on the NuMaker-M2A23SG.
JP2	V_{SS} connector on the NuMaker-M2A23SG.

Table 3-8 Power Connectors

3.4.6 USB Connectors

Table 3-9 presents the USB connectors.

Connector	Description
ICEJ2	ICE USB connector on Nu-Link2-Me for power supply, debugging and programming from PC.
J3	USB power connector on NuMaker-M2A23SG for power supply.

Table 3-9 USB Connectors

3.4.7 Power Switches

Table 3-10 presents the power switches.

Switch	Description
ICEJPR1	Configures the target chip operating voltage at 1.8V / 3.3V / 5V. **Note:** M2A23 operating voltage range is from 2.5V to 5.5V. Do not switch ICEJPR1 (MCUVCC) to 1.8V.
ICEJPR2	Configures the ICE chip operating voltage at 1.8V / 3.3V.
SW2	Configures the target chip operating voltage at 3.3V / 5V. **Note:** If user wants to switch SW2.1 (NU1 5VCC) to ON, user should short or solder a 0 Ω resistor to R12.

Table 3-10 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 ICEJ2 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 ICEJ2.

Table 3-11 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	ICEJ2	ICEJPR1 (MCUVCC) Selection [1]	ICEJPR2 (ICEVCC) Selection [2]	ICE Chip Voltage	SW2 Selection	J3	Vin	JP1
1	3.3V	Connect to PC	3.3V (default)	3.3V (default)	3.3V	Off	-	-	3.3V output
2	5V	Connect to PC	5V	3.3V (default)	3.3V	Off	-	-	5V output

Note:

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

Table 3-11 Supply External Power through Nu-Link2-Me

3.4.8.2 External Power Supply through MA23SG Target Board to Target Chip

The external power supply sources on M2A23 target board are shown in Figure 3-6.

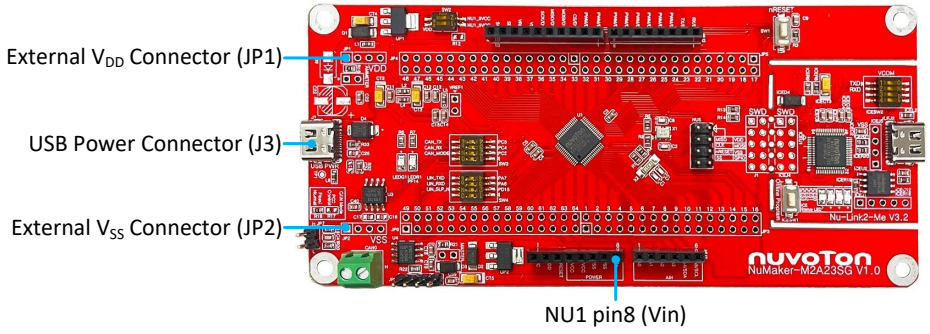


Figure 3-6 External Power Supply Sources on M2A23 Target Board

To use Vin, J3 or JP8 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, J3 or JP8.

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 ICEJ2 to PC.
5. Connect the external power supply to JP1.

To use Vin, J3 or JP8 as external power supply source with Nu-Link2-Me detached from NuMaker-M2A23SG, please follow the steps below:

1. Switch the SW2 depending on the target chip operating voltage.
2. Detach the Nu-Link2-Me from NuMaker-M2A23SG.
3. Connect the external power supply to Vin, J3 or JP8.

To use JP1 as external power supply source with Nu-Link2-Me detached from NuMaker-M2A23SG, please follow the steps below:

1. Switch the SW2 to OFF.
2. Detach the Nu-Link2-Me from NuMaker-M2A23SG.
3. Connect the external power supply to JP1.

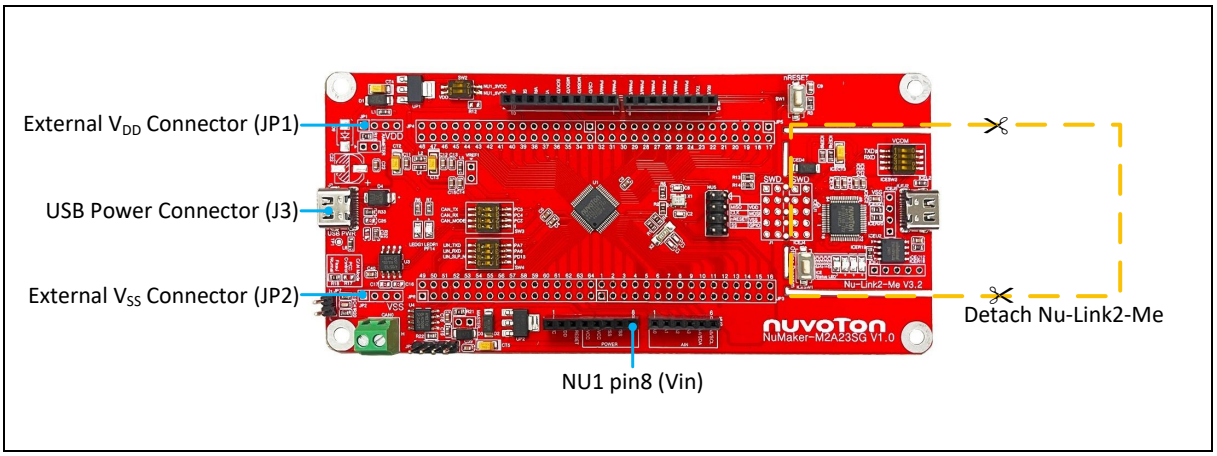


Figure 3-7 Detach the Nu-Link2-Me from NuMaker-M2A23SG

Table 3-12 presents all power models when supplies external power through M2A23 target board. The M2A23 target board external power sources are highlighted in yellow.

Model	Target Chip Voltage	Vin [1]	J3[1]	JP8[1]	ICEJ2	SW2 Selection	JP1[2]	ICEJPR1 (MCUVCC) Selection [3]	ICEJPR2 (ICEVCC) Selection [4]	ICE Chip Voltage [5]
3	3.3V	7V ~ 12V Input	-	-	-	NU1 3VCC	3.3V output	Remove resistor	3.3V	3.3V
4	3.3V	-	Connect to PC	-	-	NU1 3VCC	3.3V output	Remove resistor	3.3V	3.3V
5	3.3V	-	-	Connect to LIN bus	-	NU1 3VCC	3.3V output	Remove resistor	3.3V	3.3V
6	5V	7V ~ 12V Input	-	-	-	NU1 5VCC [6]	5V output	Remove resistor	3.3V	3.3V
7	5V	-	Connect to PC	-	-	NU1 5VCC [6]	5V output	Remove resistor	3.3V	3.3V
8	5V	-	--	Connect to LIN bus	-	NU1 5VCC [6]	5V output	Remove resistor	3.3V	3.3V
9	2.5V ~ 5.5V	-	-	-	Connect to PC	OFF	DC Input 2.5V ~ 5.5V	Remove resistor	1.8V / 3.3V	1.8V / 3.3V
10	2.5V ~ 5.5V	-	-	-	Nu-Link2-Me removed	OFF	DC Input 2.5V ~ 5.5V	-	-	-

Note:

1. The Vin input voltage will be converted by voltage regulator UP2 to 5V. Supplying external power to Vin, J3 or JP8 can provide 5V to NU1 pin5 (5V) and 3.3V 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 1.8V / 3.3V / 5V.
4. 0 Ω should be soldered between ICEJPR2's ICEVCC and 1.8V / 3.3V.
5. The ICE chip voltage should be close to the target chip voltage.
6. 0 Ω should be soldered to R12 or short R12.
7. -: Unused

Table 3-12 Supply External Power for M2A23 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 3-13 External Reference Voltage Connector

3.6 Ammeter Connector

User can refer to the sample code in M2A23 series BSP - SYS_PowerDown_MinCurrent and Figure 3-8 to measure the minimum current in Power-down mode. Figure 3-9 shows the path of the sample code, which has relative settings of entering Power-down mode.

Table 3-14 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 3-14 Ammeter Connector

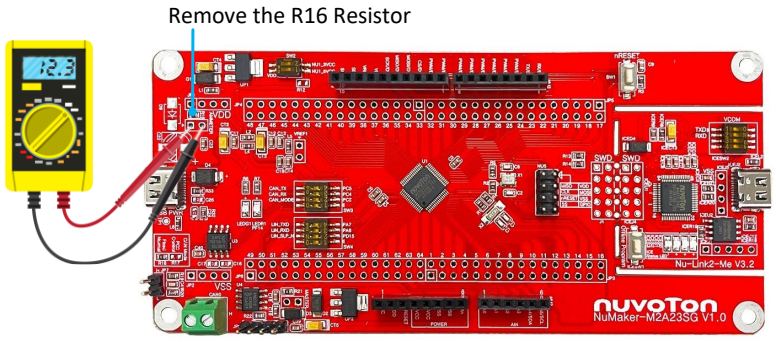


Figure 3-8 Wiring between Ammeter Connector and Ammeter

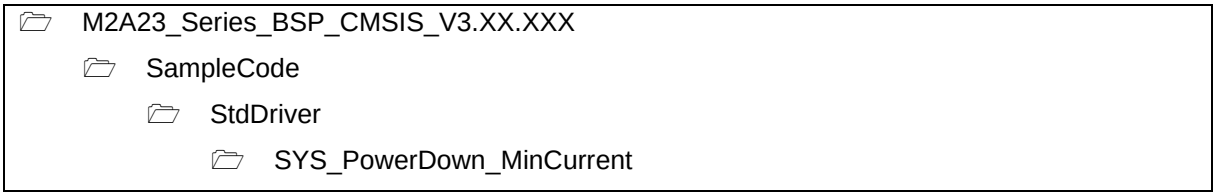


Figure 3-9 Project Path of SYS_PowerDown_MinCurrent

3.7 Function Switches

Table 3-15 presents the function switches.

Component	Description
SW3	Switch both SW3.3 and SW3.4 to ON to enable PC.4 and PC.5 to CAN transceiver. Switch SW3.2 to ON to enable PC.3 to control CAN mode.
SW4	Switch both SW4.3 and SW4.4 to ON to enable PA.6 and PA.7 to LIN transceiver. Switch SW4.2 to ON to enable PD.15 to control LIN mode.

Table 3-15 Function Switches

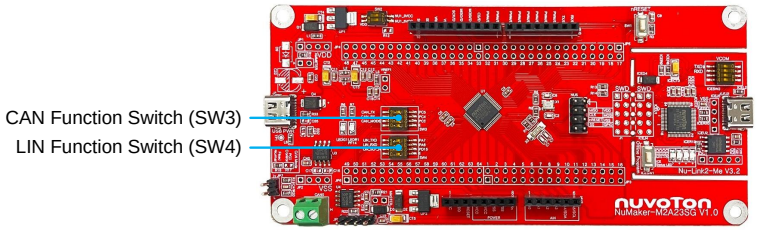


Figure 3-10 Function Switches on NuMaker-M2A23SG

3.8 CAN Mode Selection

Table 3-16 presents all selection to control operating mode of CAN transceiver. The control sources are highlighted in yellow.

Model	CAN Operating Mode	R18	R17	PC.3	SW3.3	SW3.4	SW3.2
1	Disable	-	-	-	OFF	OFF	OFF
2	Normal	0Ω	-	-	ON	ON	OFF
3	Normal	-	0Ω	Low	ON	ON	ON
4	Silent	-	0Ω	High	ON	ON	ON
Note: -: Unused							

Table 3-16 Operating Mode of CAN Transceiver

3.9 LIN Mode Selection

Table 3-17 presents all selection to control operating mode of LIN transceiver. The control sources are highlighted in yellow.

Model	LIN Operating Mode	R21	MASTER	PD.15	SW4.3	SW4.4	SW4.2
1	Reset	-	-	-	OFF	OFF	OFF
2	Master Normal	0Ω	-	High	ON	ON	ON
3	Master Sleep	0Ω	-	Low	ON	ON	ON
4	Master Normal	-	0Ω	High	ON	ON	ON
5	Master Sleep	-	0Ω	Low	ON	ON	ON
6	Slave Normal	-	-	High	ON	ON	ON
7	Slave Sleep	-	-	Low	ON	ON	ON
Note: -: Unused							

Table 3-17 Operating Mode of LIN Transceiver

3.10 Push Buttons

Table 3-18 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 3-18 Push Buttons

3.11 LEDs

Table 3-19 presents the LEDs.

Component	Description
Power LED	The power LED indicates that the NuMaker-M2A23SG is powered.
PF14 LED	The LED is connected to the target chip PF.14.
ICES0, ICES1, ICES2 and ICES3	Nu-Link2-Me status LED.

Table 3-19 LEDs

3.12 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*.

3.12.1 VCOM Switches

Table 3-20 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 3-20 VCOM Function of Nu-Link2-Me

3.12.2 Status LEDs

Table 3-19 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 3-21 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 – Full Cortex-M
- 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.

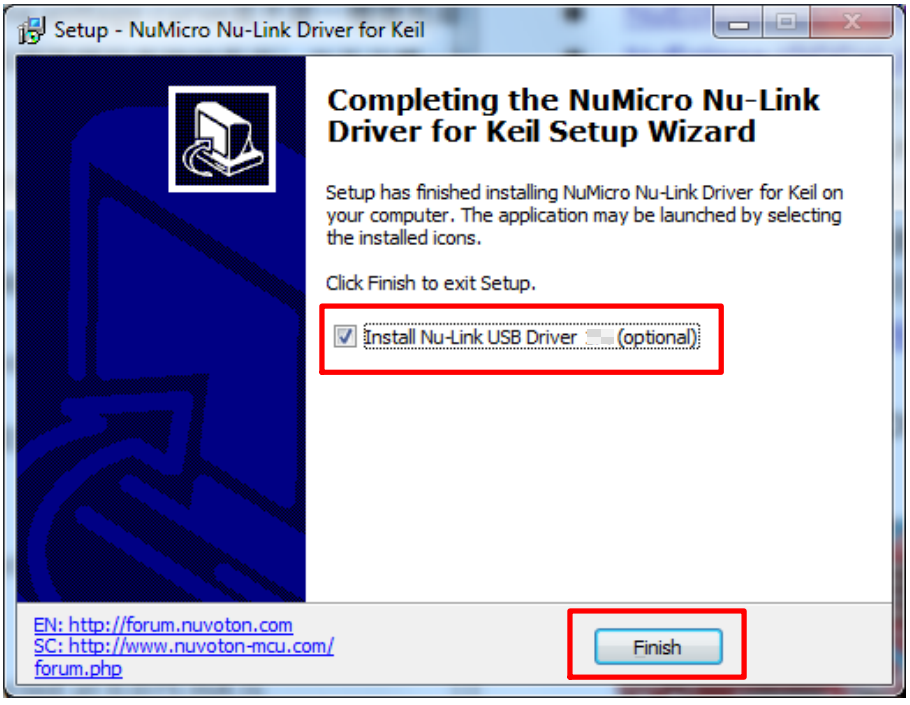


Figure 4-1 Nu-Link USB Driver Installation Setup

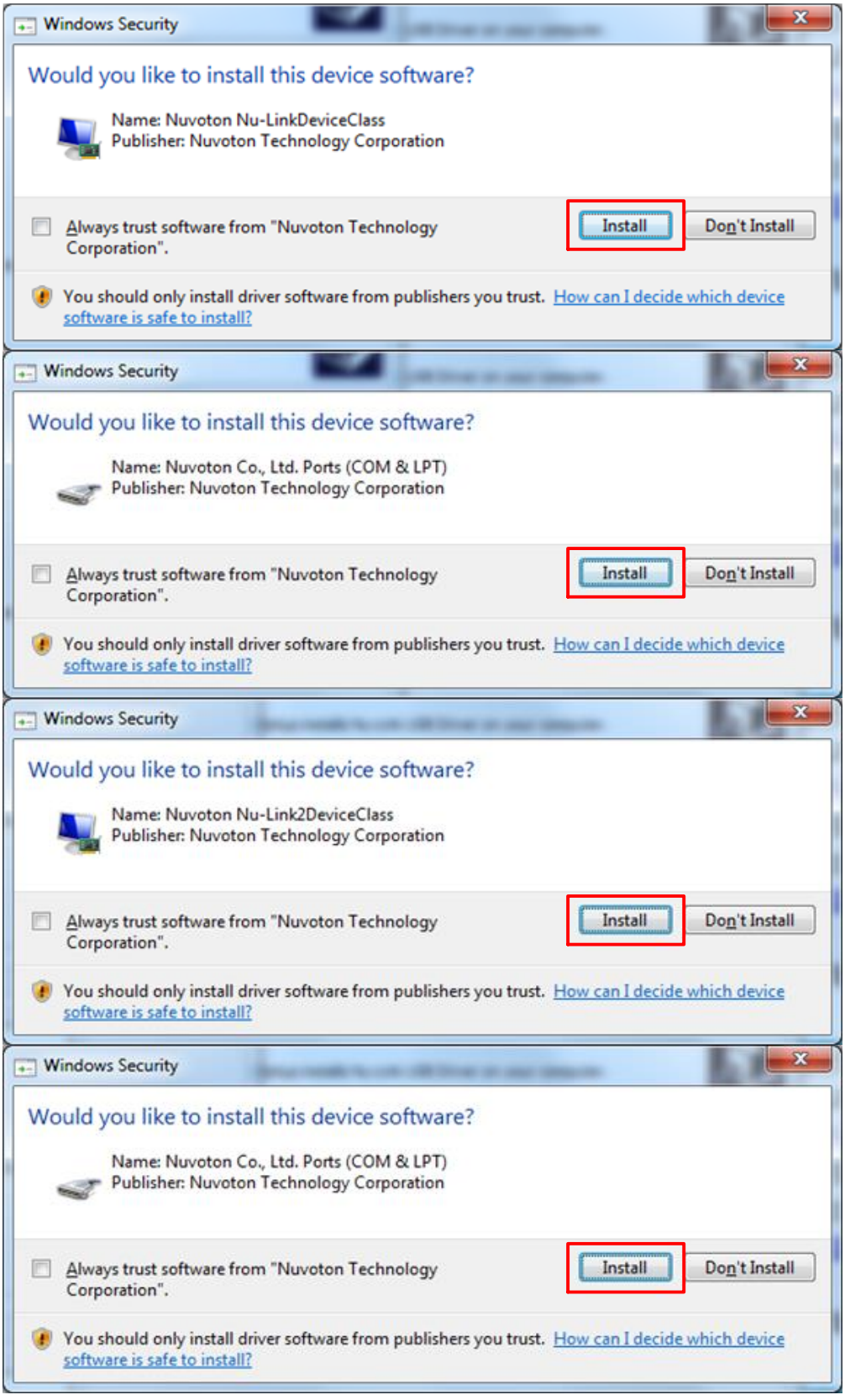


Figure 4-2 Nu-Link USB Driver Installation

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.

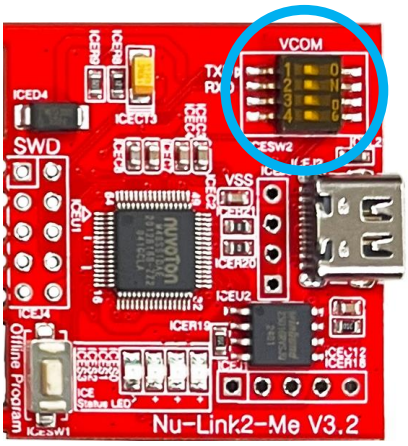


Figure 4-3 Open VCOM Function

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

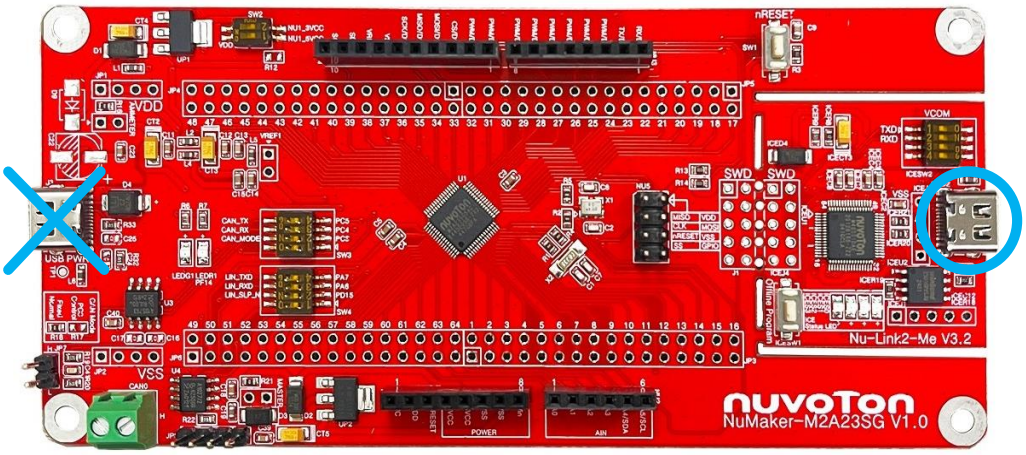


Figure 4-4 ICE USB Connector

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

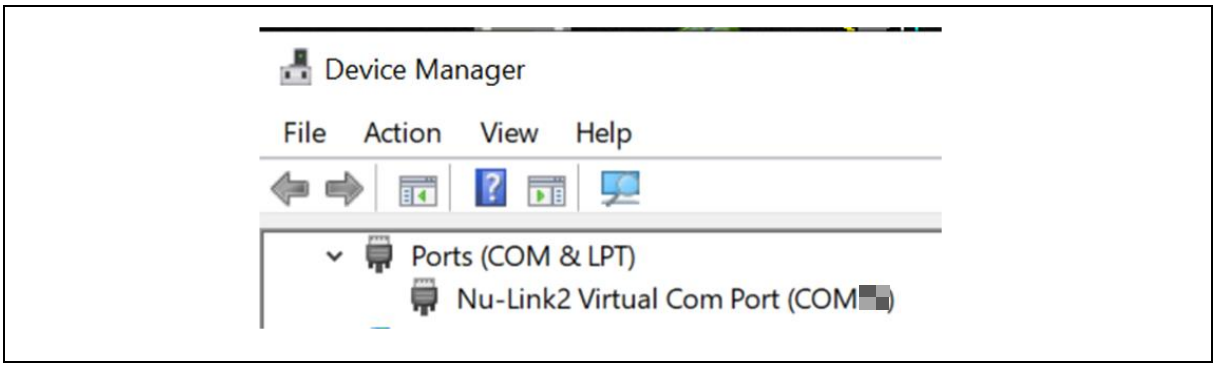


Figure 4-5 Device Manager

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.

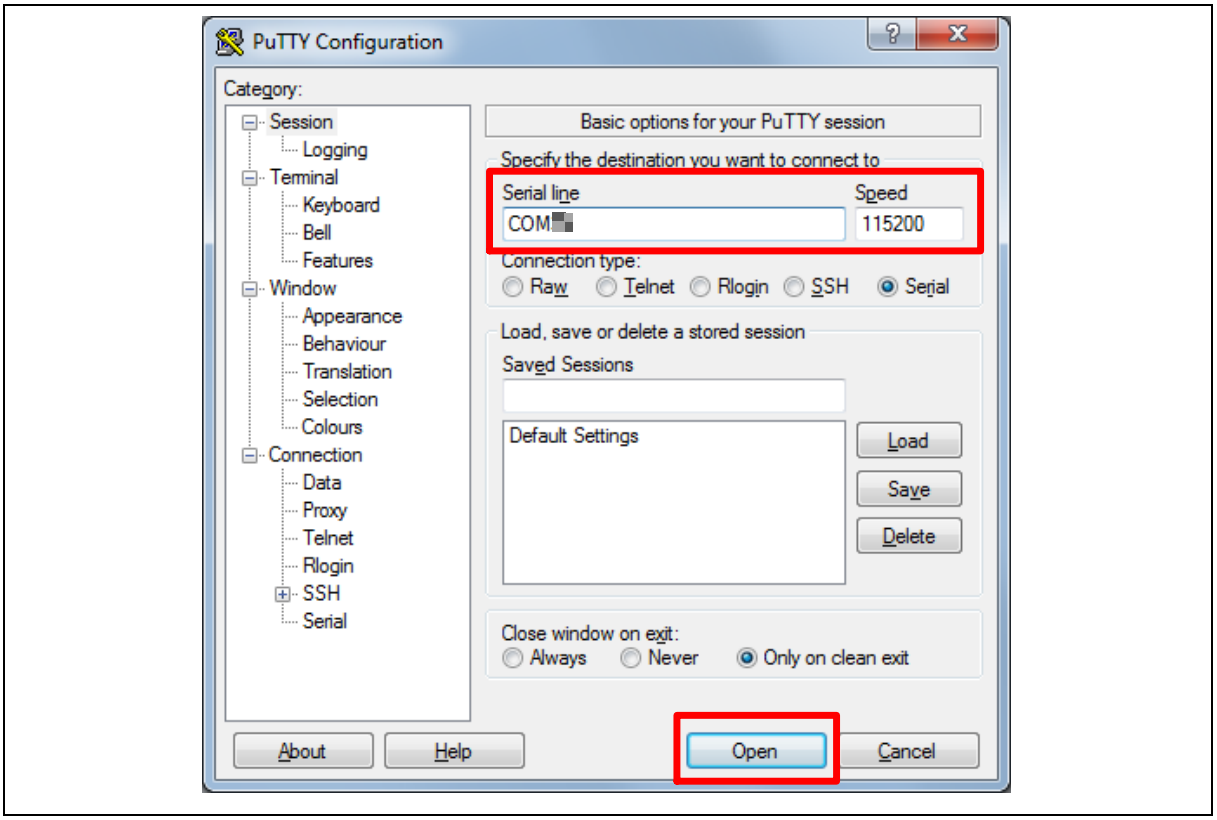


Figure 4-6 PuTTY Session Setting

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.

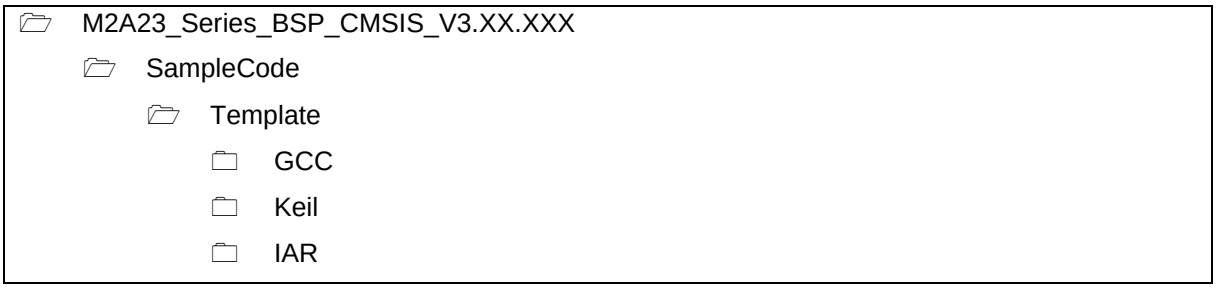


Figure 4-7 Template Project Folder Path

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.

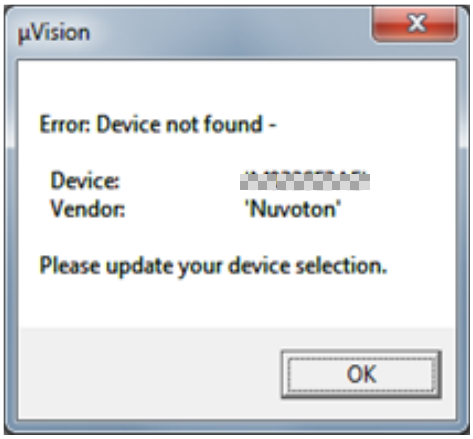


Figure 4-8 Warning Message of “Device not found”

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”.

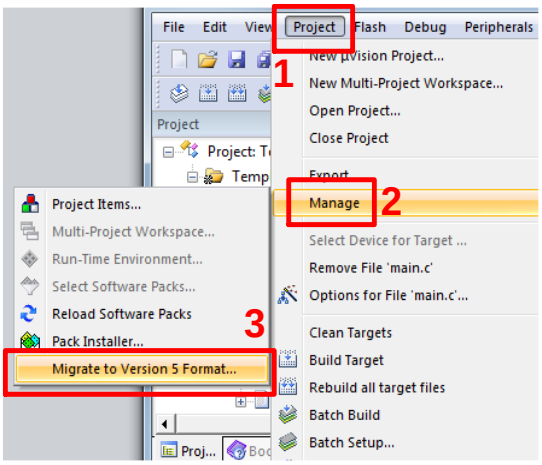


Figure 4-9 Project File Migrate to Version 5 Format

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

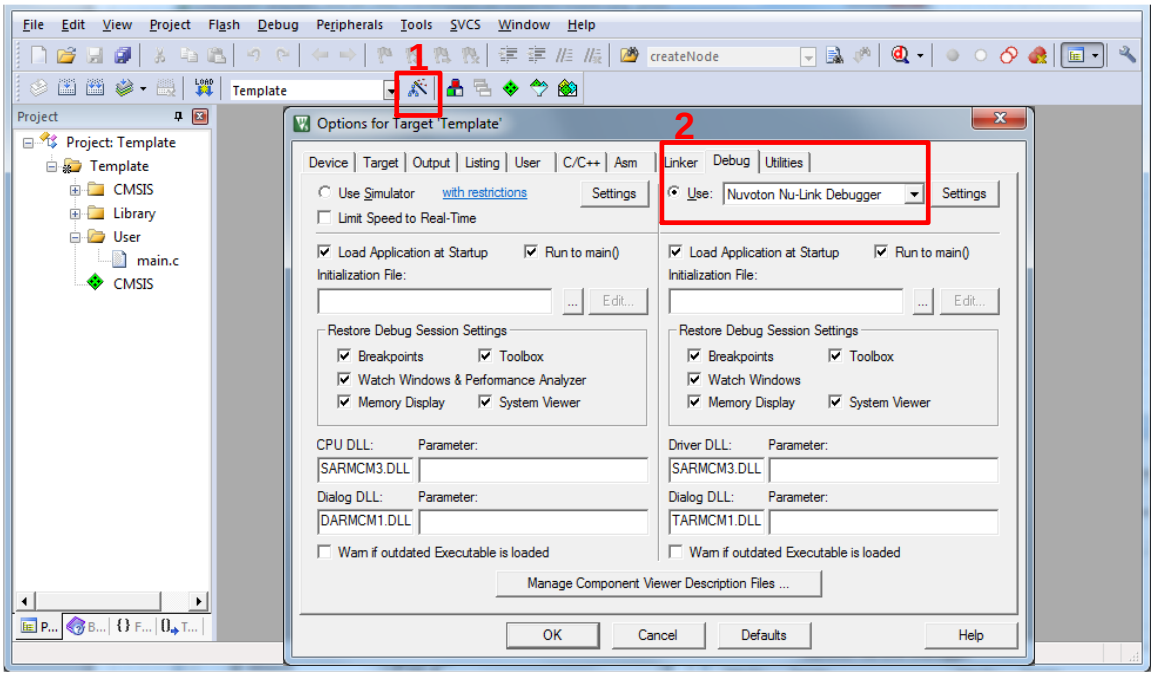


Figure 4-10 Debugger Setting in Options Window

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

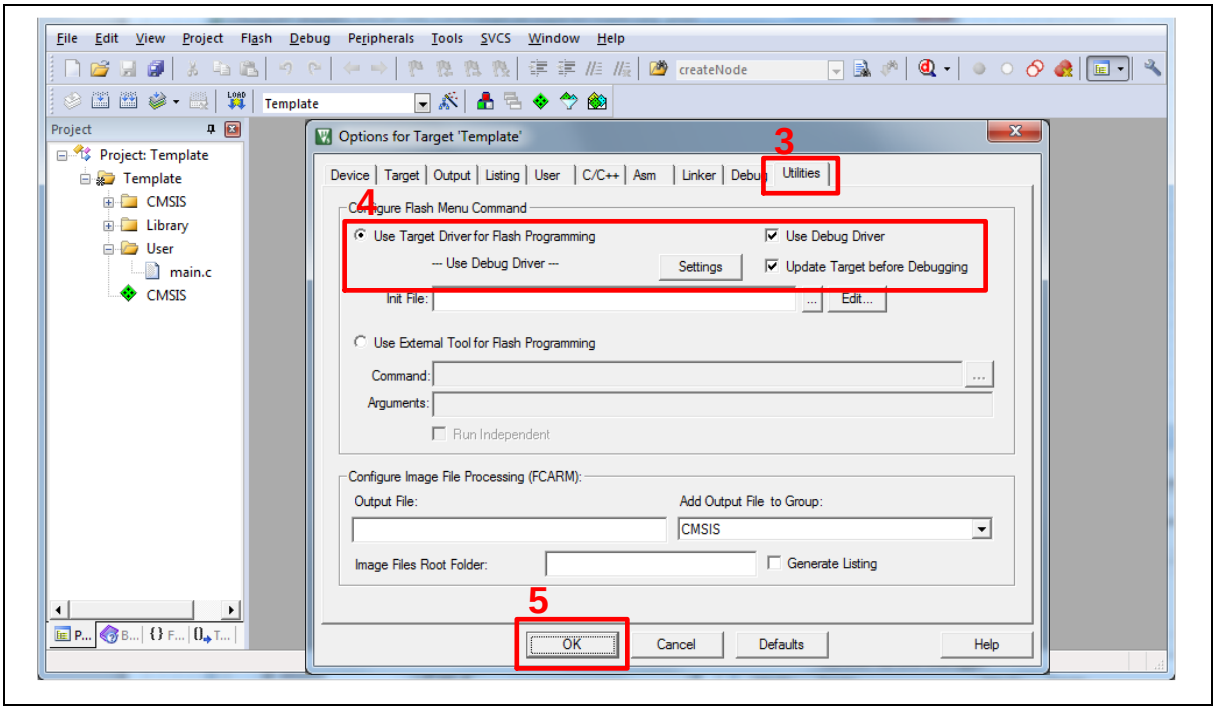


Figure 4-11 Programming Setting in Options Window

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.

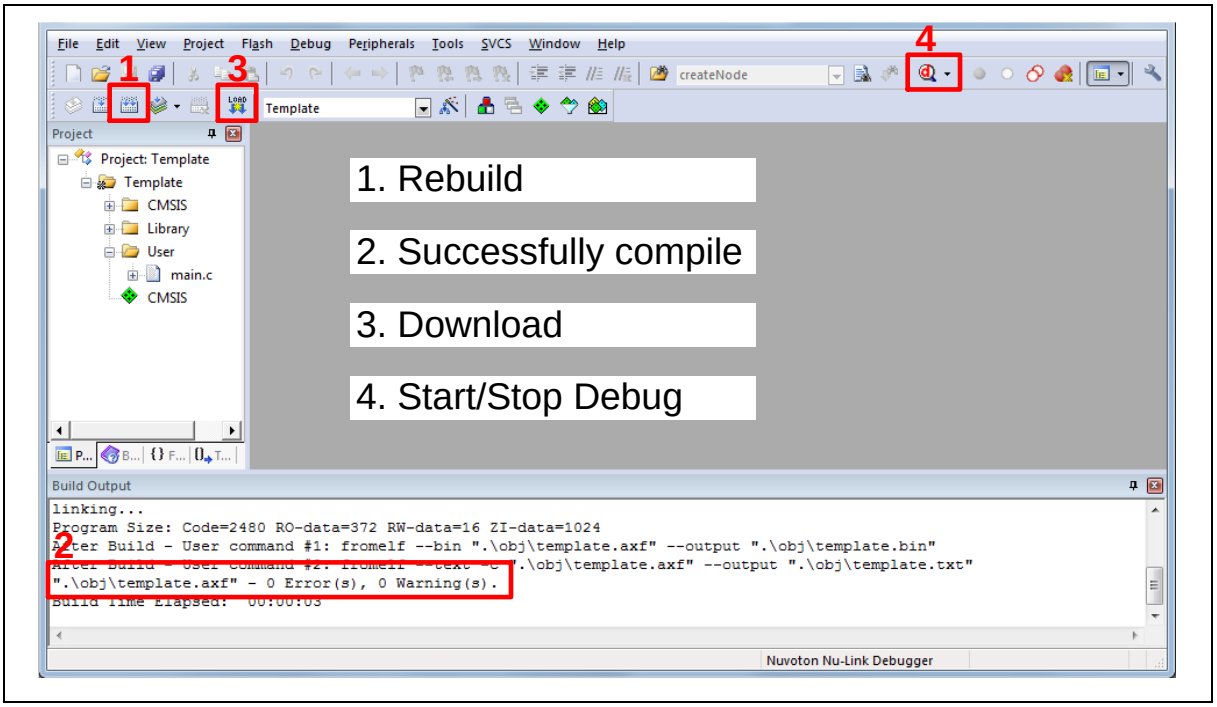


Figure 4-12 Compile and Download the Project

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.

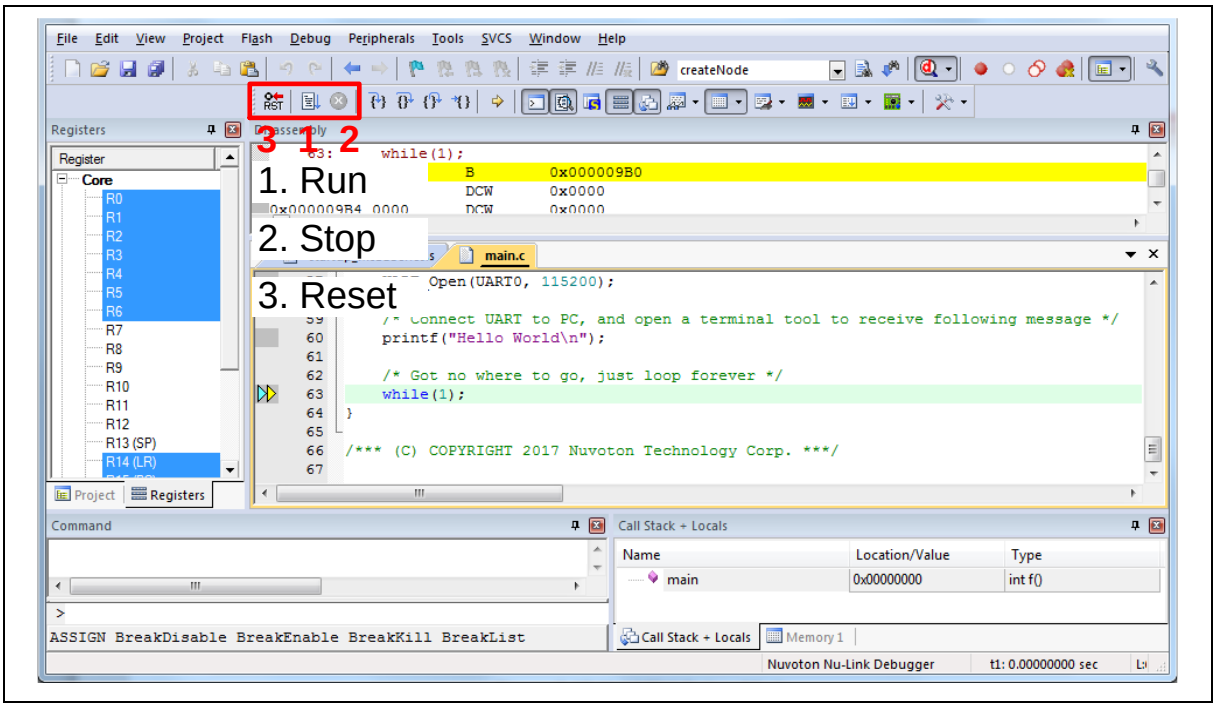


Figure 4-13 Keil MDK Debug Mode

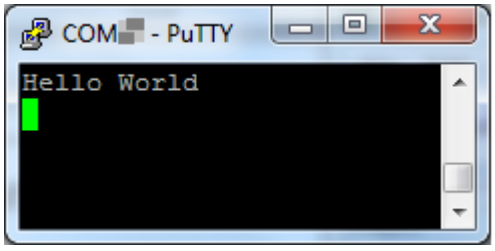


Figure 4-14 Debug Message on Serial Port Terminal Windows

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.

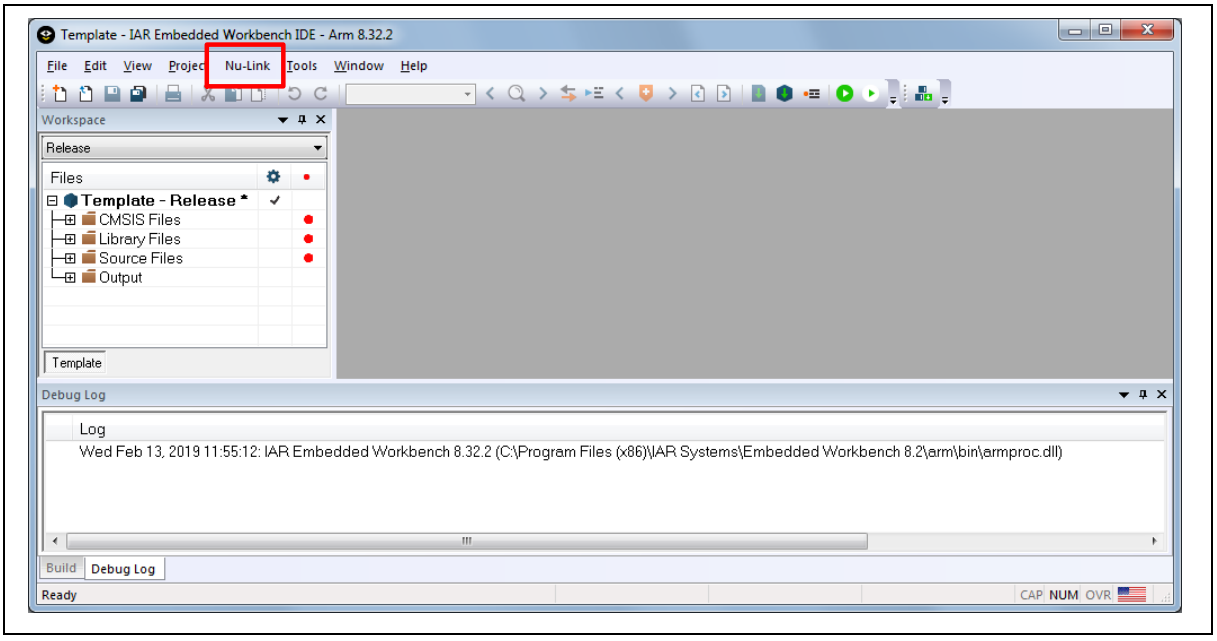


Figure 4-15 IAR EWARM Window

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.

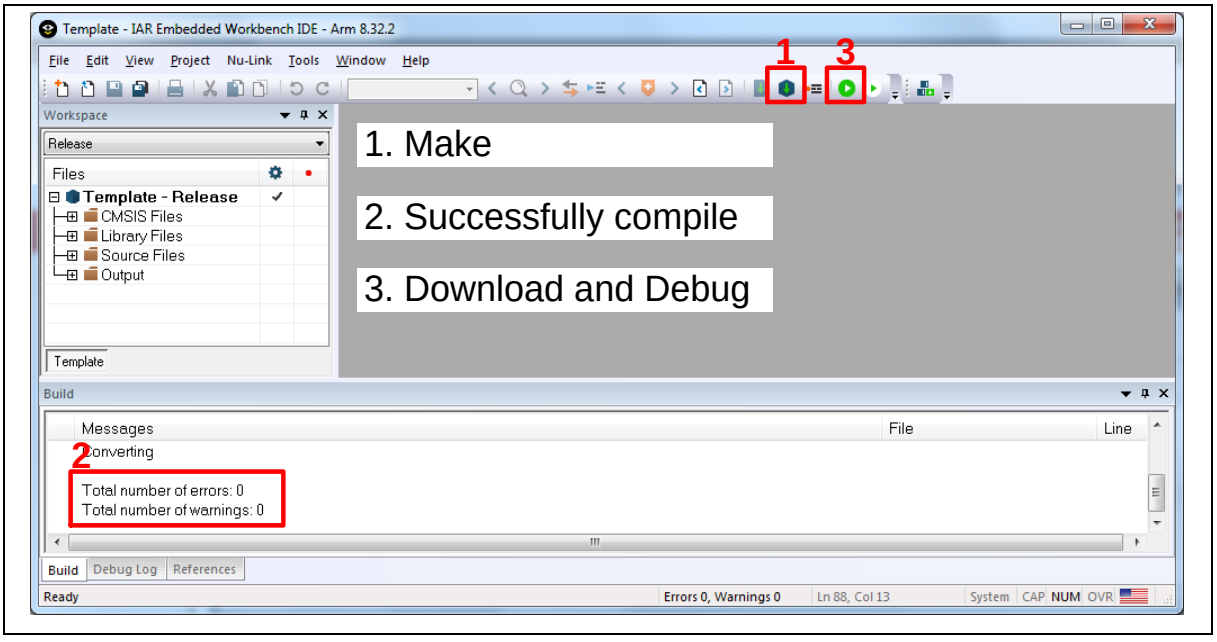


Figure 4-16 Compile and Download the Project

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.

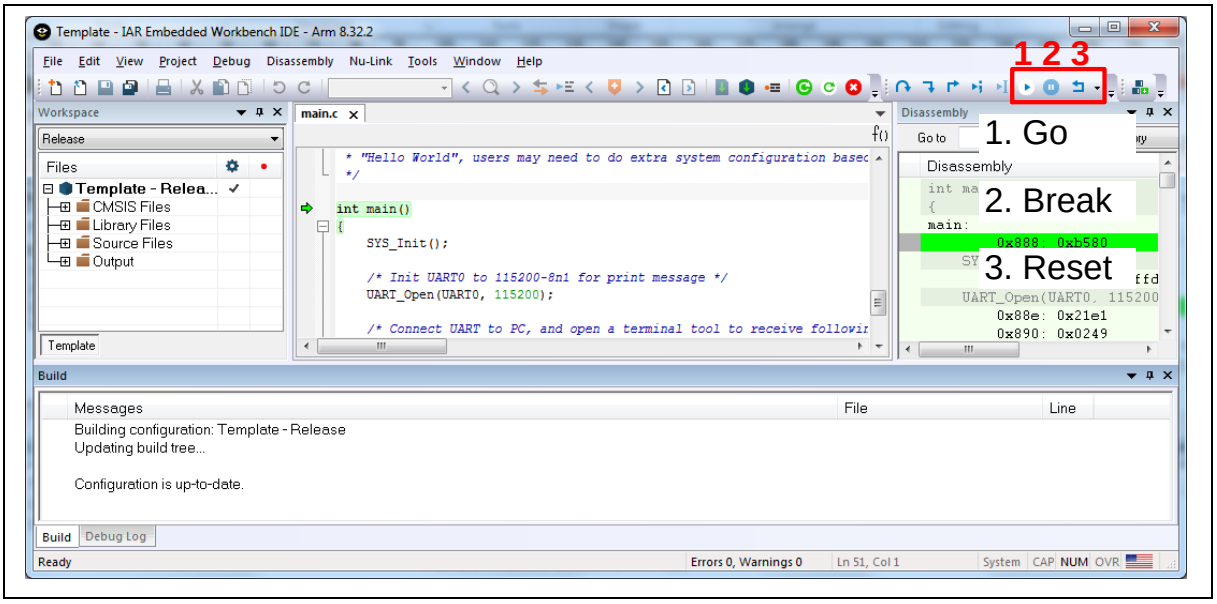


Figure 4-17 IAR EWARM Debug Mode

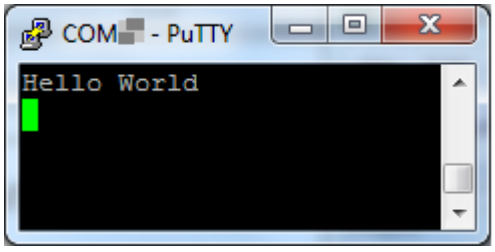


Figure 4-18 Debug Message on Serial Port Terminal Windows

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.

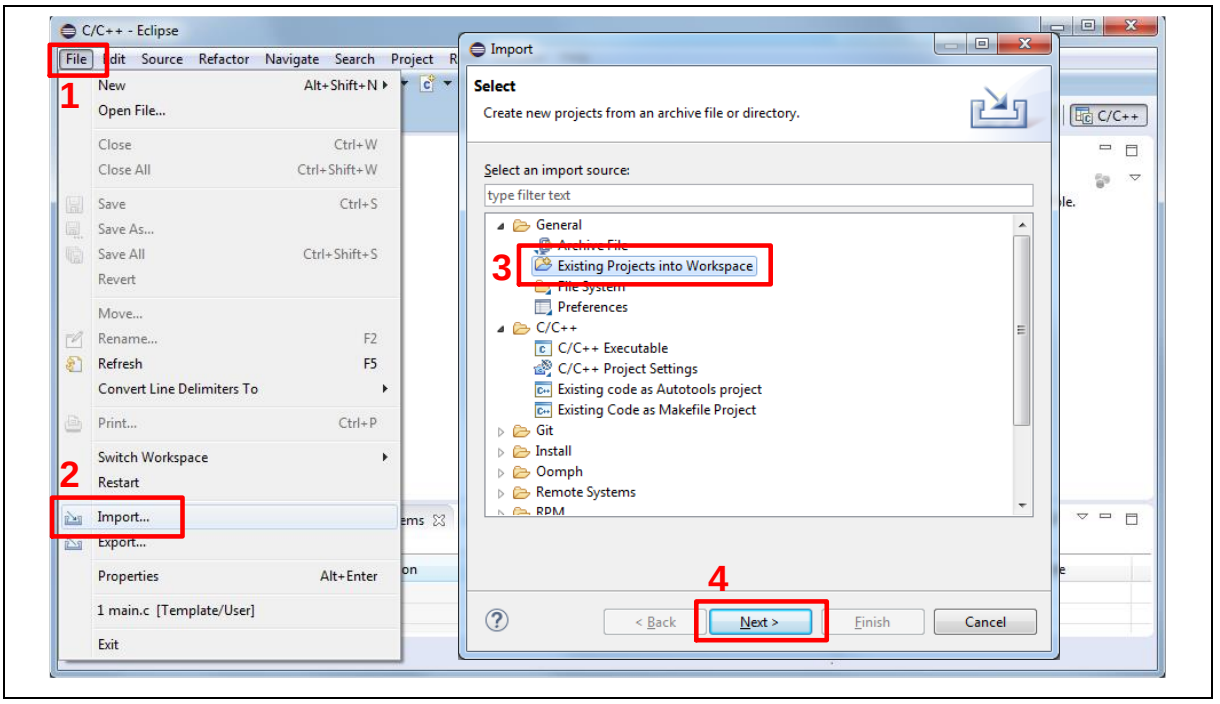


Figure 4-19 Import the Project in NuEclipse

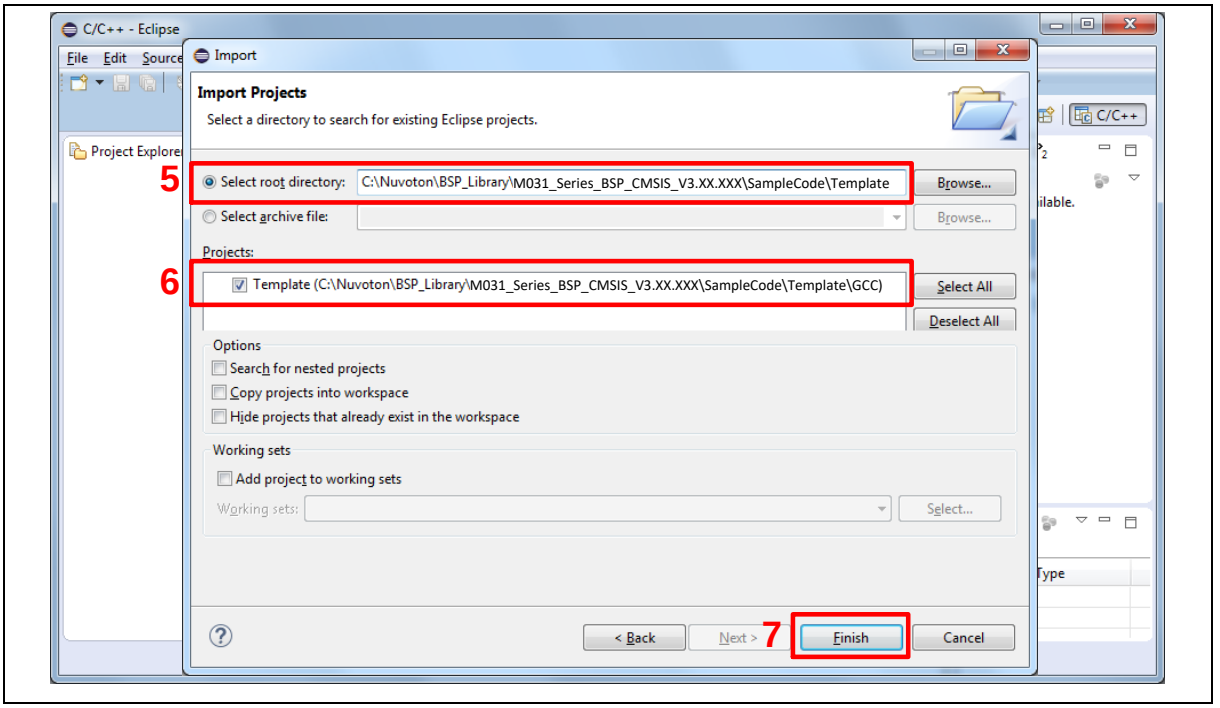


Figure 4-20 Import Projects Windows

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.

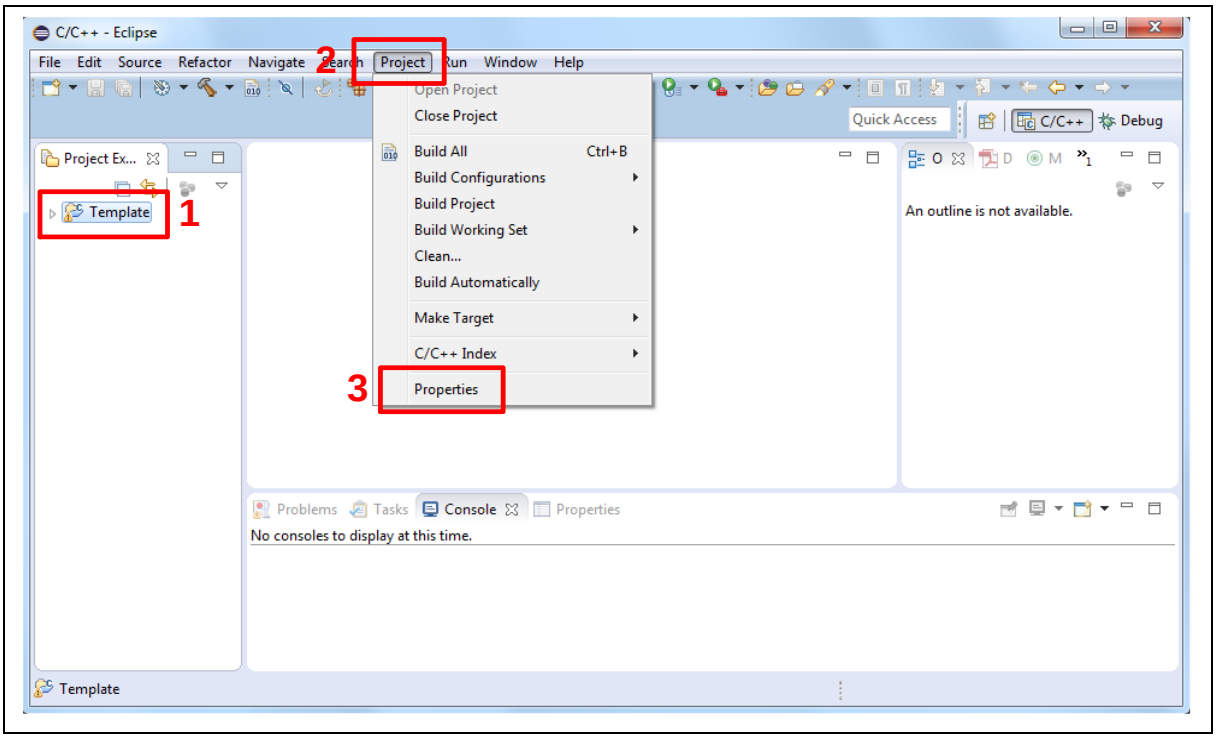


Figure 4-21 Open Project Properties Window

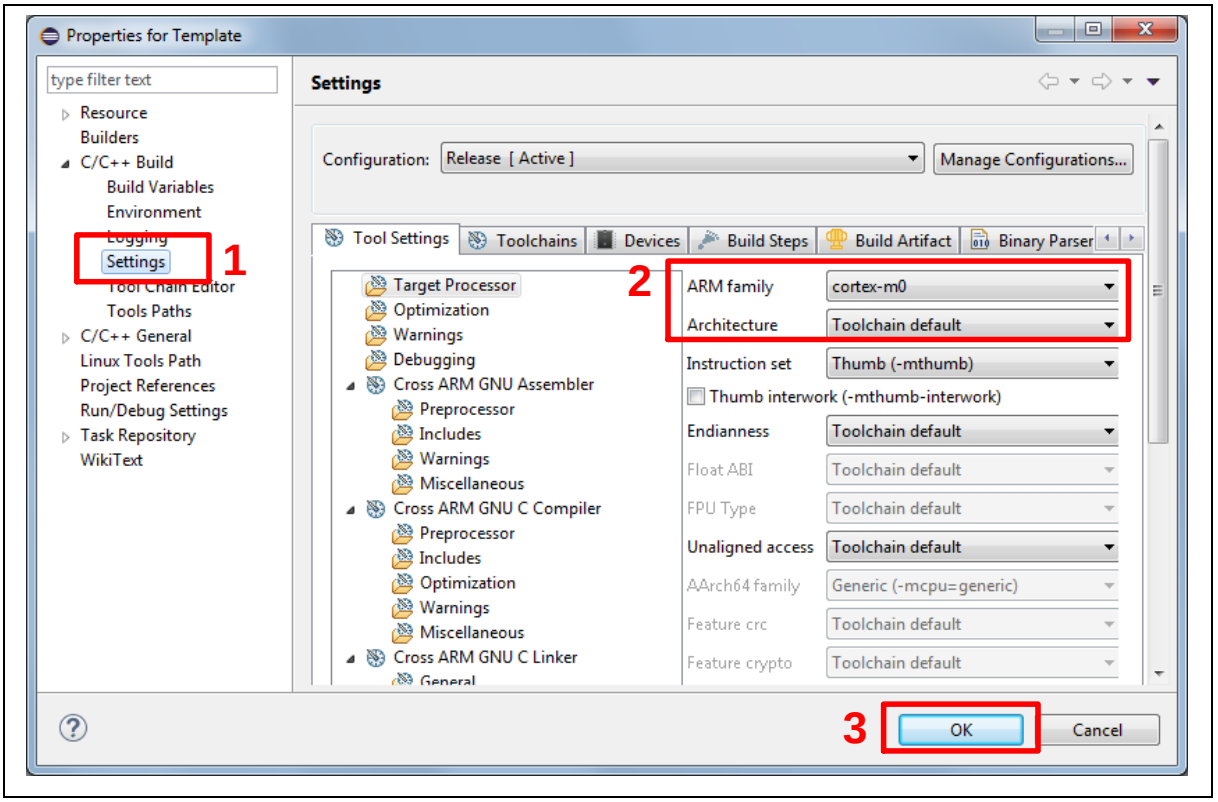


Figure 4-22 Project Properties Settings

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

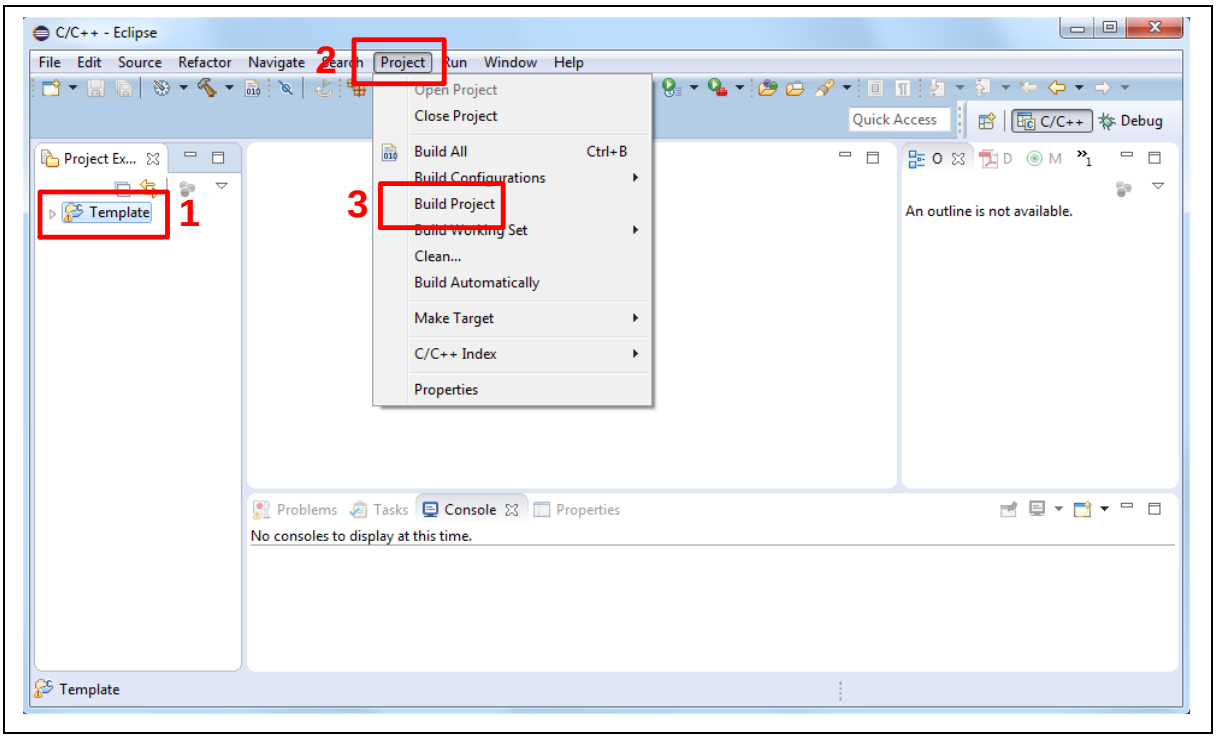


Figure 4-23 Build Project

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.

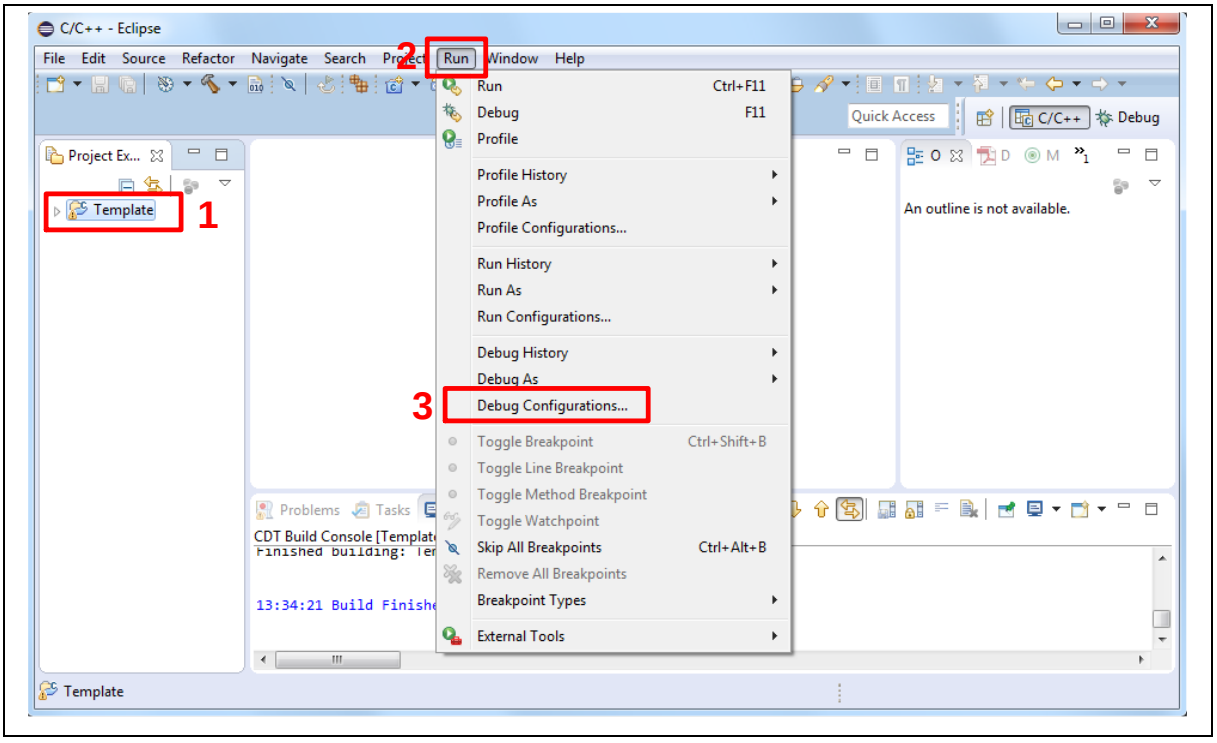
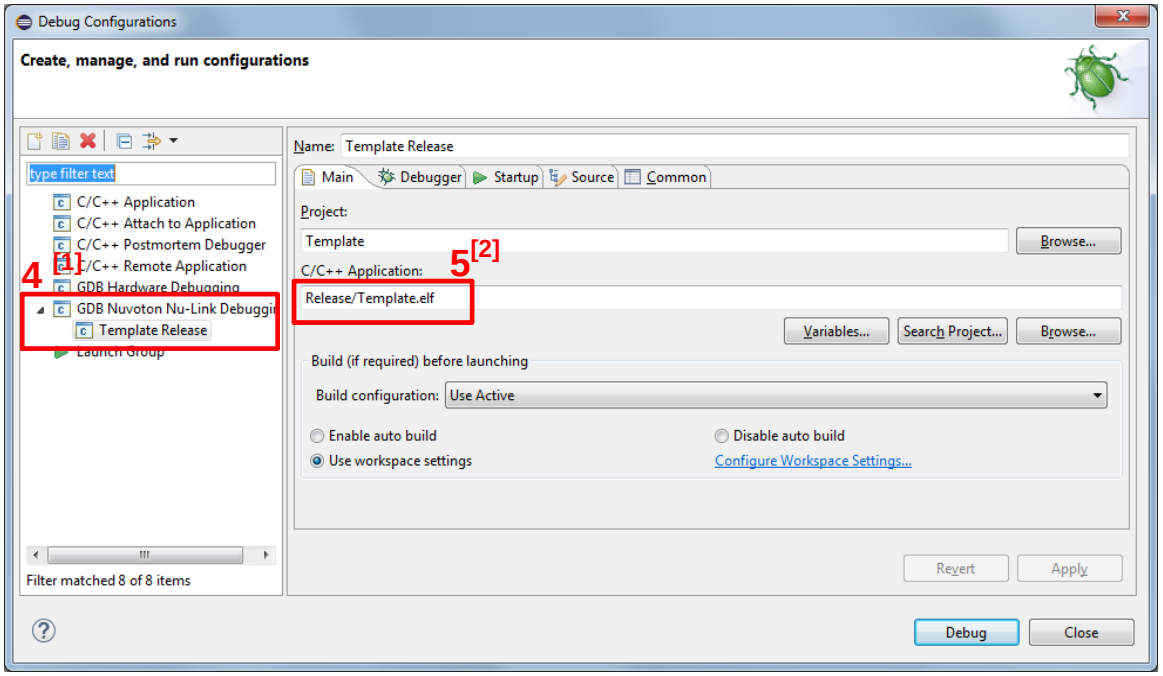


Figure 4-24 Open Debug Configuration



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

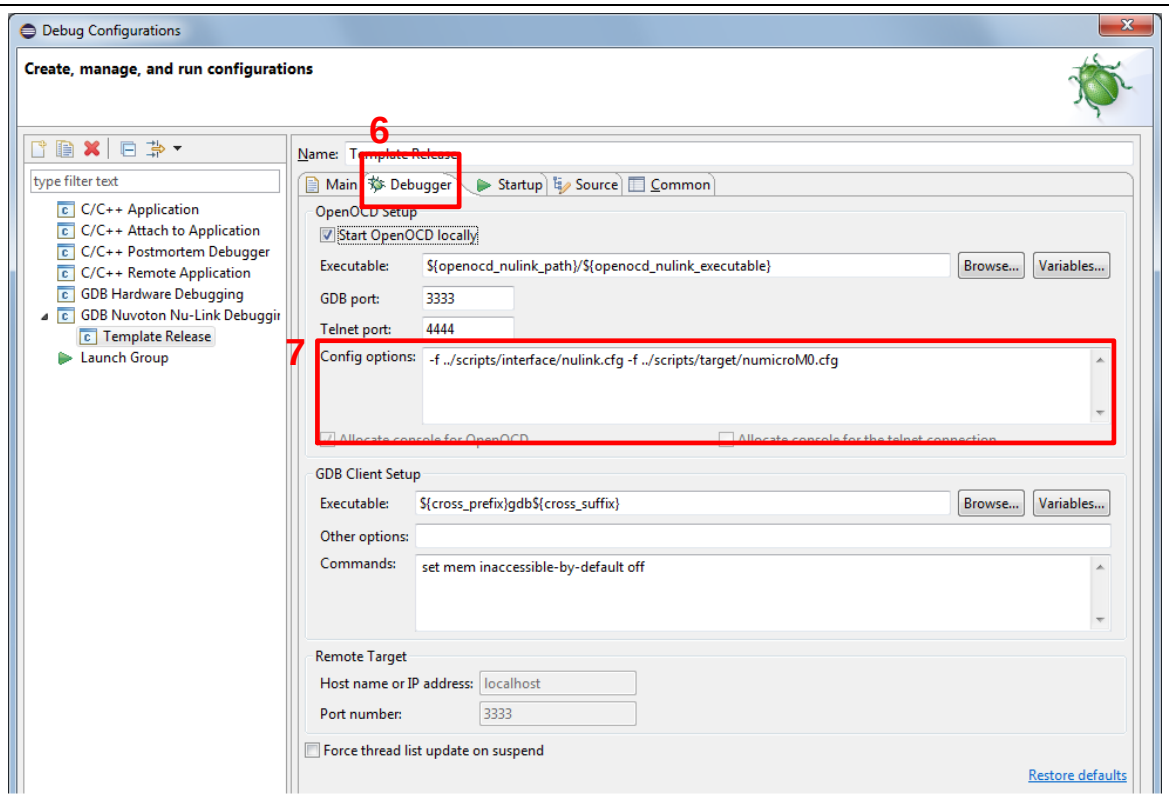
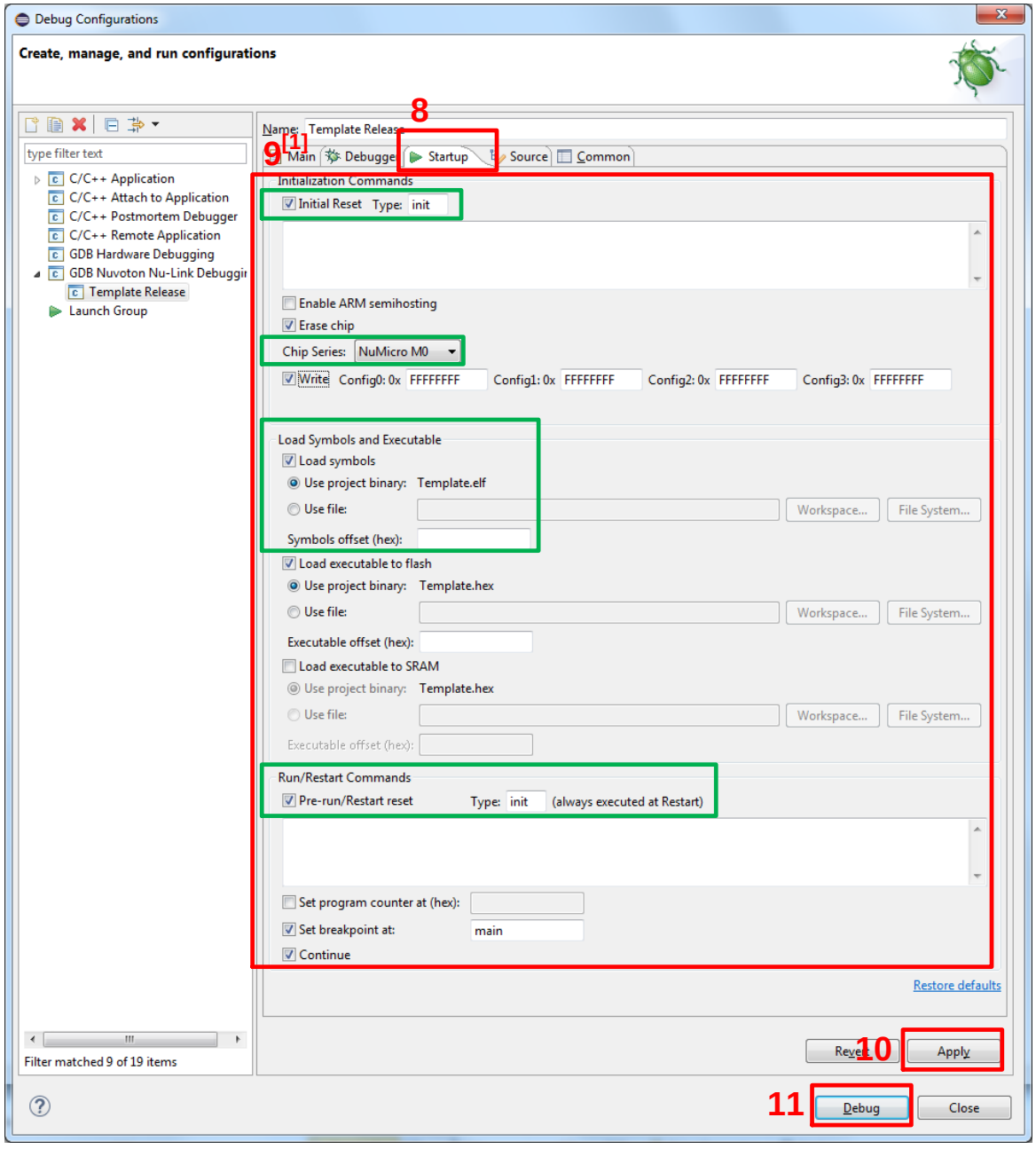


Figure 4-26 Debugger Tab Configuration



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*.

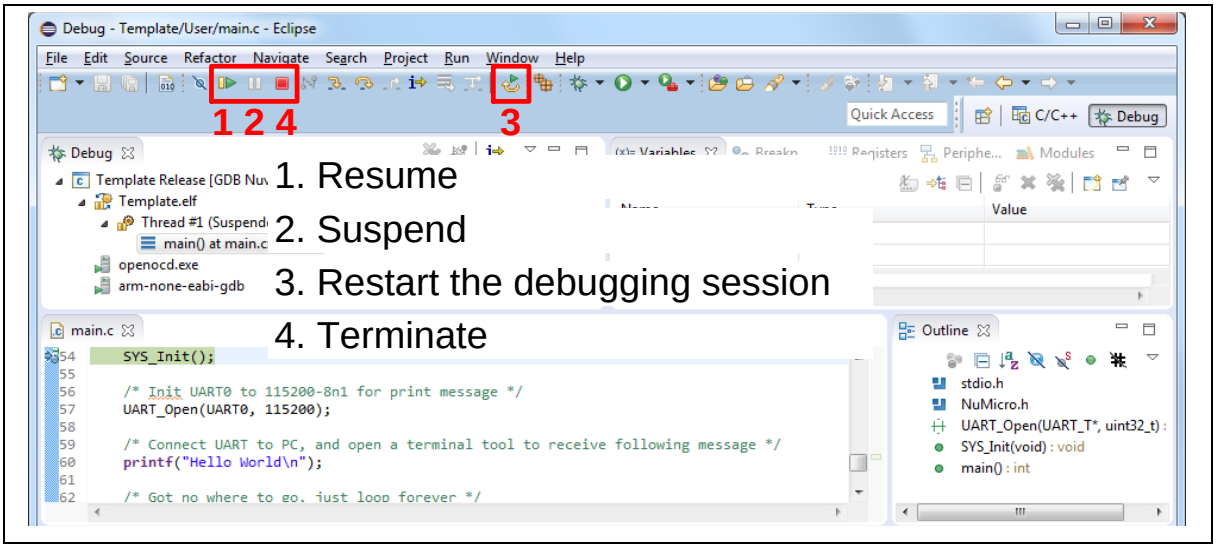


Figure 4-28 NuEclipse Debug Mode

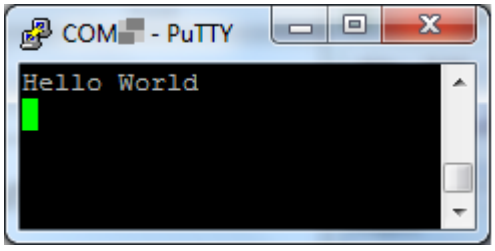


Figure 4-29 Debug Message on Serial Port Terminal Windows

5 NUMAKER-M2A23SG SCHEMATICS

5.1 Nu-Link2-Me

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

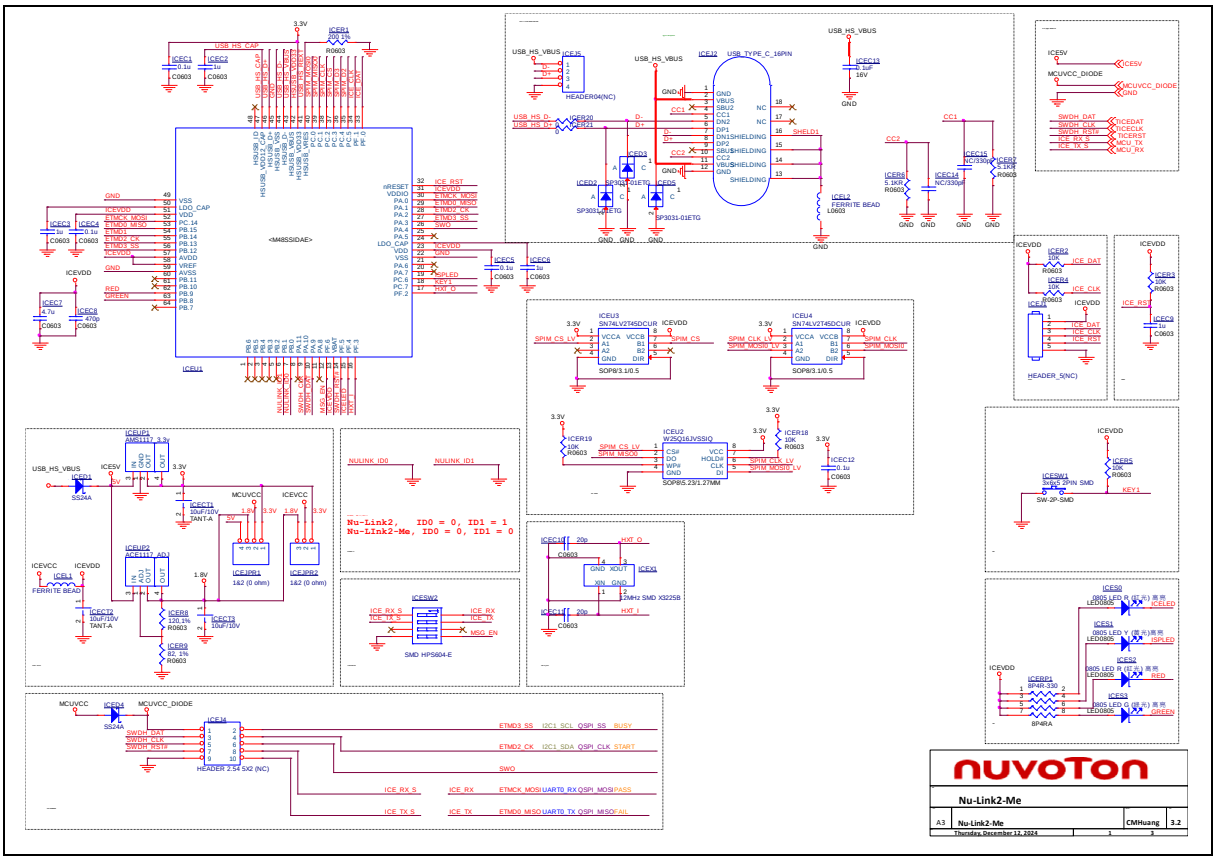


Figure 5-1 Nu-Link2-Me Circuit

5.2 M2A23 Target Board

Figure 5-2 shows the M2A23 target board circuit.

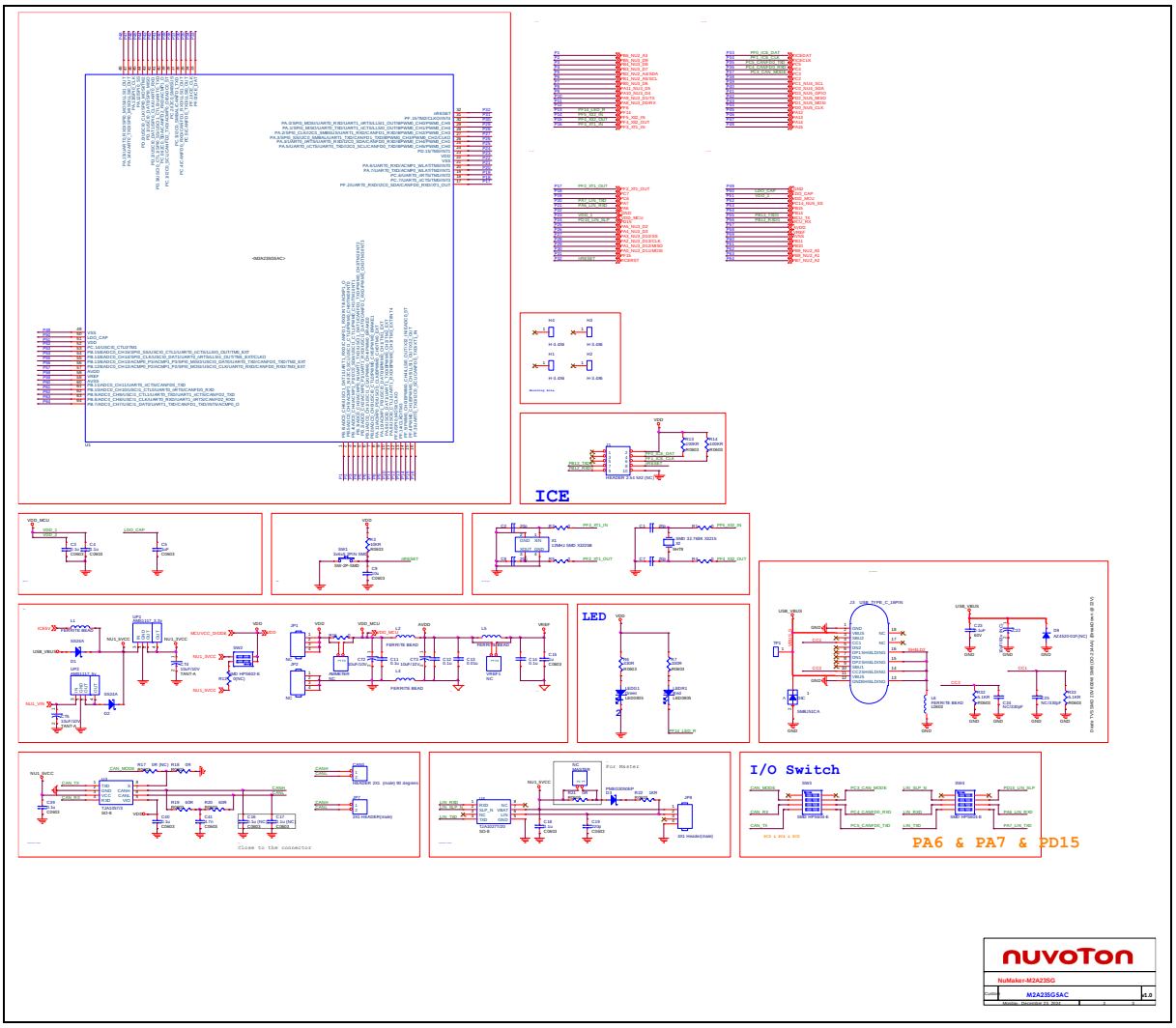


Figure 5-2 M2A23 Target Board Circuit

5.3 Extension Connectors

Figure 5-3 shows extension connectors of NuMaker-M2A23SG.

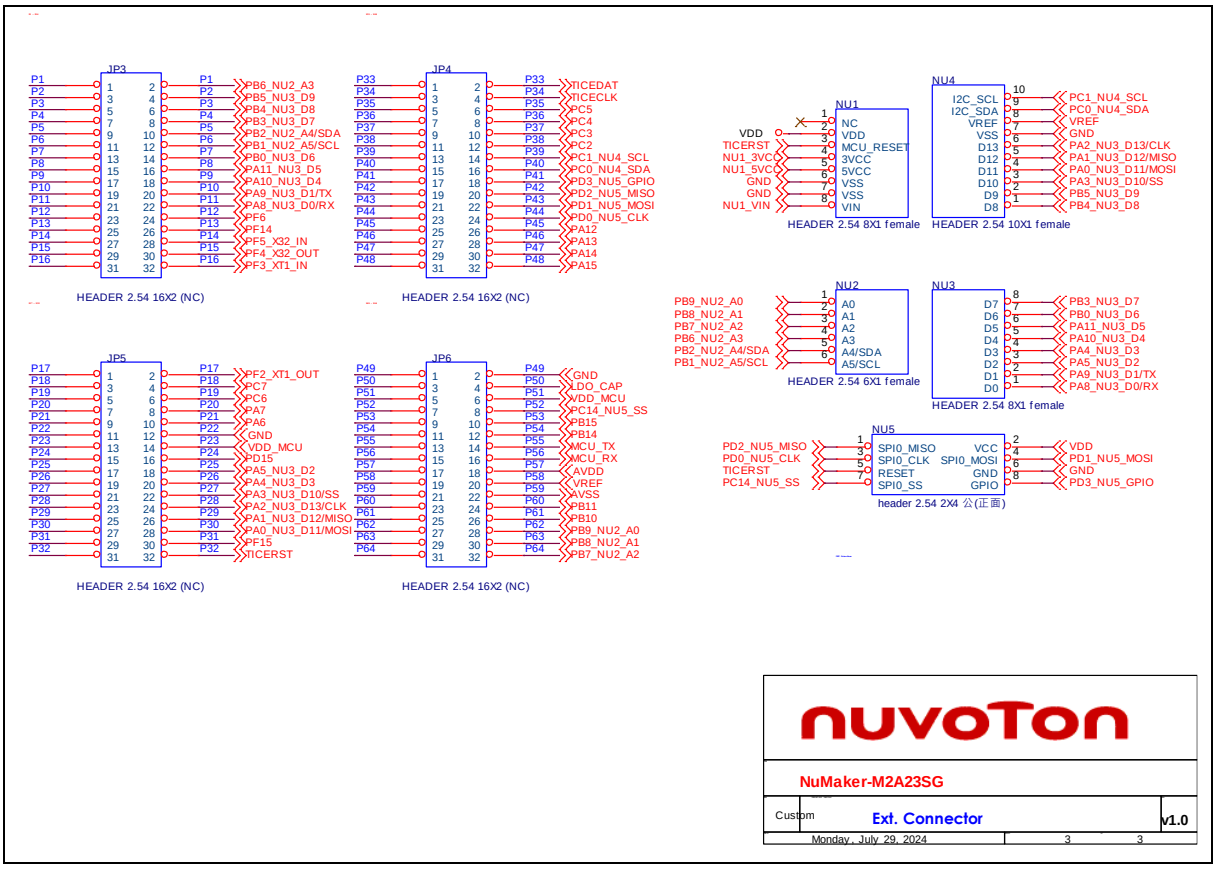


Figure 5-3 Extension Connectors Circuit

5.4 PCB Placement

Figure 5-4 and Figure 5-5 show the front and rear placement of NuMaker-M2A23SG.

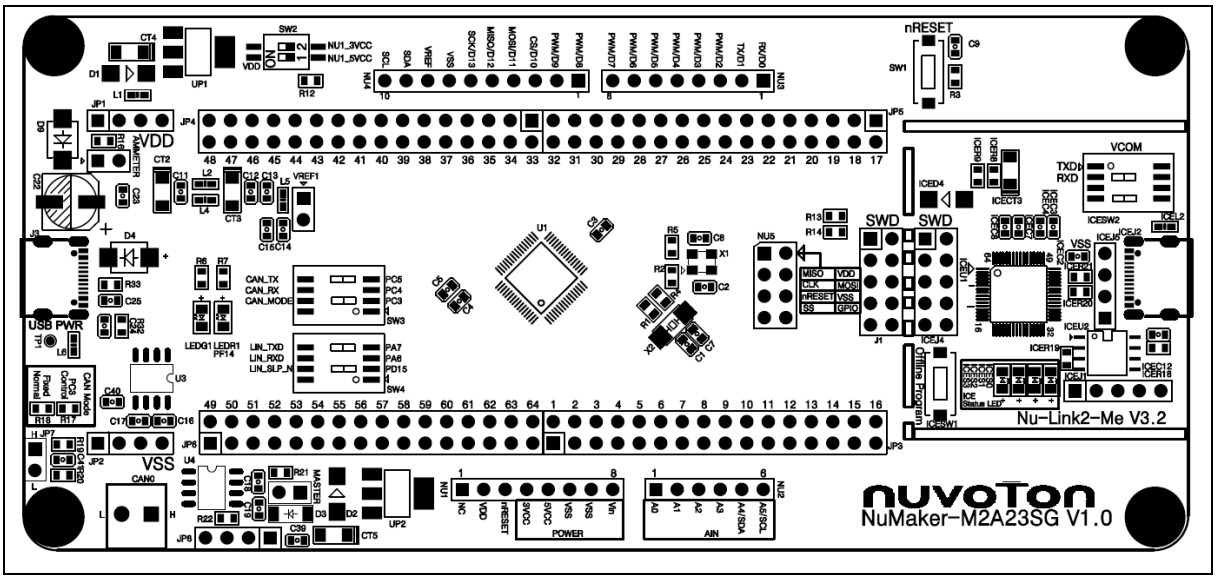


Figure 5-4 Front Placement

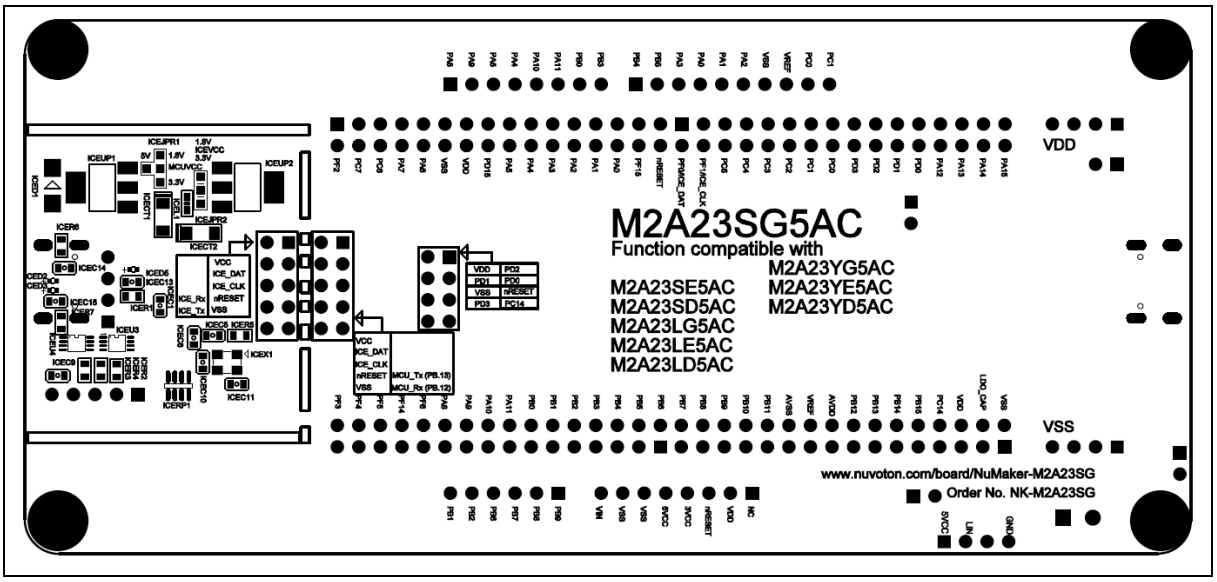


Figure 5-5 Rear Placement

6 REVISION HISTORY

Date	Revision	Description
2025.02.20	1.00	● Initial version.

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