NuMicro® Family

Based on Arm® Cortex®-M0

NuMaker-M0A23EC

User Manual

Evaluation Board for NuMicro® M0A21/M0A23 Series

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

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Table of Contents

List of Figures

List of Tables

1 OVERVIEW

The NuMaker-M0A23EC is an evaluation board for Nuvoton NuMicro M0A21 microcontrollers. The NuMaker-M0A23EC consists of two parts: a M0A21/M023 target board and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-M0A23EC is designed for project evaluation, prototype development and validation with power consumption monitoring function.

The M0A21/M0A23 target board is based on NuMicro M0A23EC1AC. For the development flexibility, the M0A21/M0A23 target board provides the extension connectors of M0A23EC1AC, 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.

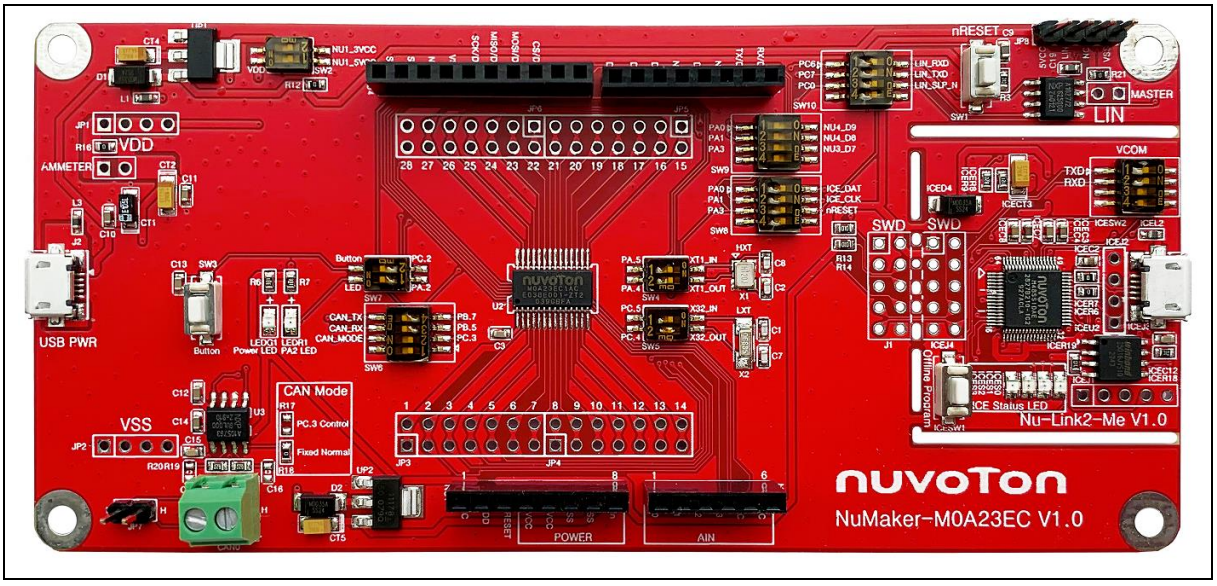


Figure 1-1 NuMaker-M0A23EC Evaluation Board

2 FEATURES

- NuMicro M0A23EC1AC microcontroller with function compatible with:
  - M0A23EC1AC
  - M0A23OC1AC
  - M0A21EC1AC
  - M0A21EB1AC
  - M0A21OC1AC
  - M0A21OB1AC
- M0A23EC1AC 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 FS connector on M0A21/M0A23 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

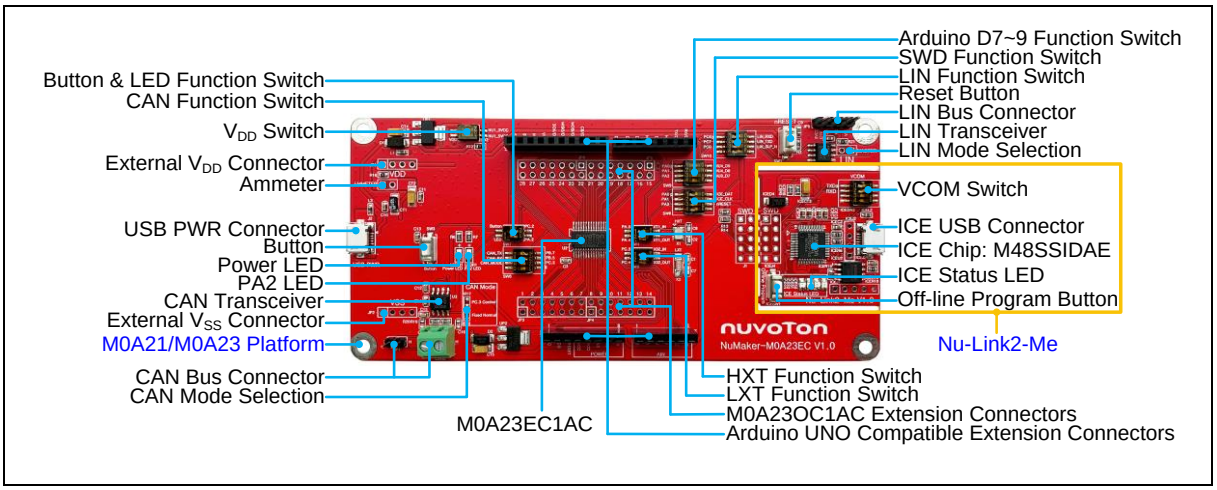


Figure 3-1 Front View of NuMaker-M0A23EC

Figure 3-1 shows the main components and connectors from the front side of NuMaker-M0A23EC. The following lists components and connectors from the front view:

- Target chip: M0A23EC1AC (U2)
- USB PWR Connector (J2)
- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)
- M0A21 Extension Connectors (JP3, JP4, JP5 and JP6)
- External V_{DD} Power Connector (JP1)
- External V_{SS} Power Connector (JP2)
- On-board CAN Transceiver (U3)
- CAN Bus Connector (JP7 and CAN0)
- CAN Function Switch (SW6)
  - Enable PB.5 and PB.7 to CAN transceiver
  - Enable PC.3 to control CAN Mode
- On-board LIN Transceiver (U4)
- LIN Bus Connector (JP8)
- LIN Function Switch (SW10)
  - Enable PC.6 and PC.7 to LIN transceiver
  - Enable PC.0 to control LIN mode
- V_{DD} Switch (SW2)
- Ammeter Connector (AMMETER)
- Reset Button (SW1)
- Power LED and PA2 LED (LEDG1 and LEDR1)
- Button (SW3)

- Button & LED Function Switch (SW7)
  - Enable PC.2 to Button
  - Enable PA.2 to LEDR1
- HXT Function Switch (SW4)
  - Enable PA.4 and PA.5 to External 12 MHz Crystal
- LXT Function Switch (SW5)
  - Enable PC.4 and PC.5 to External 32.768 kHz Crystal
- SWD Function Switch (SW8)
  - Enable PA.0 and PA.1 to ICE_DAT and ICE_CLK
  - Enable PA.3 to nRESET
- Arduino D7~9 Function Switch
  - Enable PA.0, PA.1 and PA.3 to Arduino D9, D8 and D7
- Nu-Link2-Me
  - VCOM Switch
  - ICE Chip: M48SSIDAE (ICEU2)
  - ICE USB Connector (ICEJ3)
  - ICE Status LED (ICES0, ICES1, ICES2, ICES3)
  - Off-line Program Button (ICESW1)

3.2 Rear View

Figure 3-2 shows the main components and connectors from the rear side of NuMaker-M0A23EC.

The following lists components and connectors from the rear view:

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

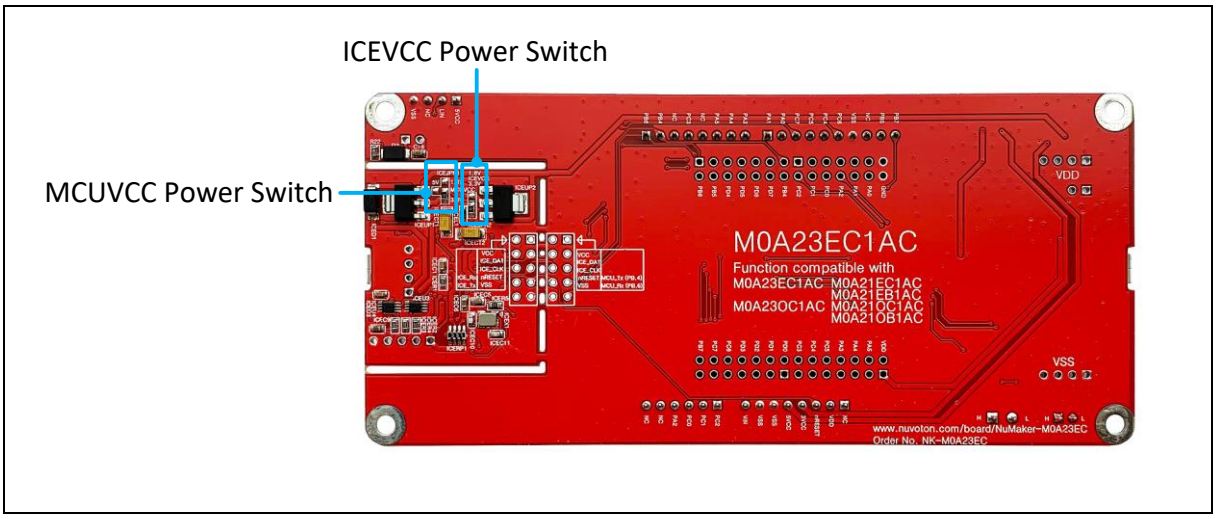


Figure 3-2 Rear View of NuMaker-M0A23EC

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-M0A23EC.
NU1, NU2, NU3 and NU4	Arduino UNO compatible pins on the NuMaker-M0A23EC.

Table 3-1 Extension Connectors

3.3.1 Pin Assignment for Extension Connectors

The NuMaker-M0A23EC provides the M0A23EC1AC onboard and extension connectors (JP3, JP4, JP5 and JP6). Figure 3-3 shows the M0A23EC1AC extension connectors.

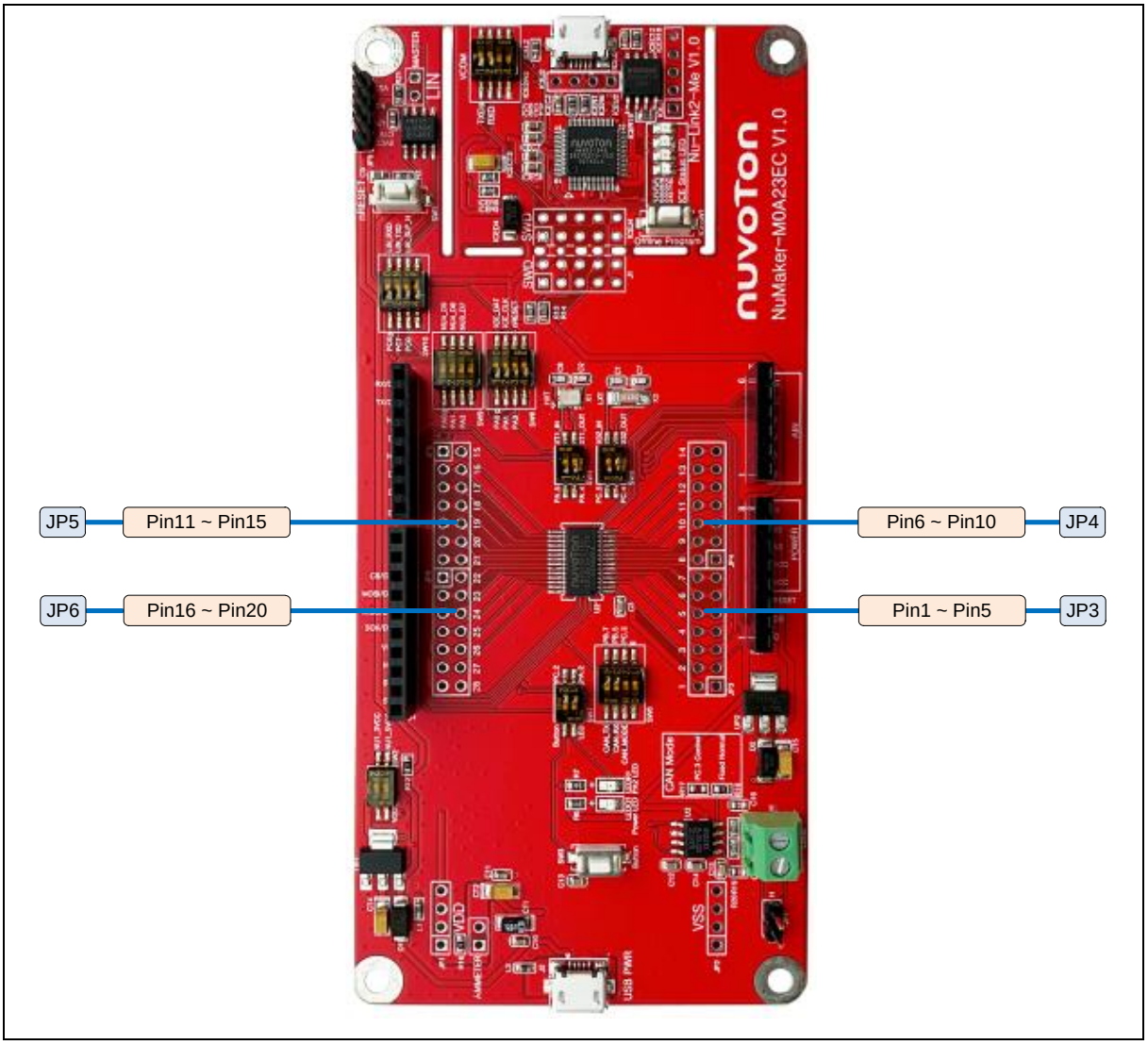


Figure 3-3 M0A23EC1AC Extension Connectors

Header		M0A23EC1AC	
		Pin No.	Function
JP3	JP3.1 JP3.2	1	V_{DD}
	JP3.3 JP3.4	2	PA.5 / ADC0_CH16 / UART0_nRTS / XT1_IN / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / ACMP0_WLAT
	JP3.5 JP3.6	3	PA.4 / ADC0_CH15 / UART0_nRTS / XT1_OUT / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / ACMP1_WLAT
	JP3.7 JP3.8	4	PA.3 / nRESET / UART0_nCTS / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_RXD / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_RXD / INT0
	JP3.9 JP3.10	5	PC.5 / ADC0_CH14 / X32_IN / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / INT1
	JP3.11 JP3.12	6	PC.4 / ADC0_CH13 / X32_OUT / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / INT2
	JP3.13 JP3.14	7	PC.3 / ADC0_CH12 / ACMP0_N3 / ACMP1_N3 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / INT3
JP4	JP4.1 JP4.2	8	PD.0 / PWM0_CH4 / UART0_TXD / USCI1_CLK / TM0
	JP4.3 JP4.4	9	PD.1 / PWM0_CH5 / UART0_RXD / USCI1_DAT0 / TM1
	JP4.5 JP4.6	10	PD.2 / PWM0_CH0 / USCI1_DAT1 / TM2 / UART1_nCTS
	JP4.7 JP4.8	11	PD.3 / PWM0_CH1 / USCI1_CTL0 / TM3 / UART1_nRTS
	JP4.9 JP4.10	12	PC.6 / ADC0_CH11 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / INT4
	JP4.11 JP4.12	13	PC.7 / ADC0_CH10 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / INT5
	JP4.13 JP4.14	14	PB.7 / ADC0_CH9 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / ACMP0_WLAT
JP5	JP5.1 JP5.2	15	PB.6 / ADC0_CH8 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / ACMP1_WLAT
	JP5.3 JP5.4	16	PB.5 / ADC0_CH7 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / INT0

Header		M0A23EC1AC	
		Pin No.	Function
	JP5.5 JP5.6	17	PD.4 / PWM0_CH0 / UART0_TXD / USCI0_CLK / TM0
	JP5.7 JP5.8	18	PD.5 / PWM0_CH1 / UART0_RXD / USCI0_DAT0 / TM1
	JP5.9 JP5.10	19	PD.6 / PWM0_CH2 / USCI0_DAT1 / TM2 / UART1_nCTS
	JP5.11 JP5.12	20	PD.7 / PWM0_CH3 / USCI0_CTL0 / TM3 / UART1_nRTS
	JP5.13 JP5.14	21	PB.4 / ADC0_CH6 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / UART1_nCTS
JP6	JP6.1 JP6.2	22	PC.2 / ADC0_CH5 / ACMP0_N2 / ACMP1_N2 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / UART1_nRTS
	JP6.3 JP6.4	23	PC.1 / ADC0_CH4 / ACMP0_N1 / ACMP1_N1 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD
	JP6.5 JP6.6	24	PC.0 / ADC0_CH3 / ACMP1_P0 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / PWM0_BRAKE0
	JP6.7 JP6.8	25	PA.2 / ADC0_CH2 / UART0_nRTS / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / PWM0_BRAKE1
	JP6.9 JP6.10	26	PA.1 / ADC0_CH1 / ACMP0_N0 / ACMP1_N0 / VREF+ / ICE_CLK / UART0_nCTS / CLKO / PWM0_CH0 / PWM0_CH2 / PWM0_CH4 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI1_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM0 / TM2 / TM0_EXT / TM2_EXT / UART1_TXD / UART1_RXD / PWM0_BRAKE0
	JP6.11 JP6.12	27	PA.0 / ADC0_CH0 / DAC0_OUT / ACMP0_P0 / ICE_DAT / UART0_nCTS / CLKO / PWM0_CH1 / PWM0_CH3 / PWM0_CH5 / UART0_TXD / UART0_RXD / USCI0_CLK / USCI0_DAT0 / USCI0_DAT1 / USCI0_CTL0 / USCI0_CTL1 / USCI1_CLK / USCI1_DAT0 / USCI1_DAT1 / USCI1_CTL0 / CAN0_TXD / CAN0_RXD / ACMP0_O / ACMP1_O / ADC0_ST / TM1 / TM3 / TM1_EXT / TM3_EXT / UART1_TXD / UART1_RXD / PWM0_BRAKE1
	JP6.13 JP6.14	28	V_{SS}

Table 3-2 M0A23EC1AC 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.

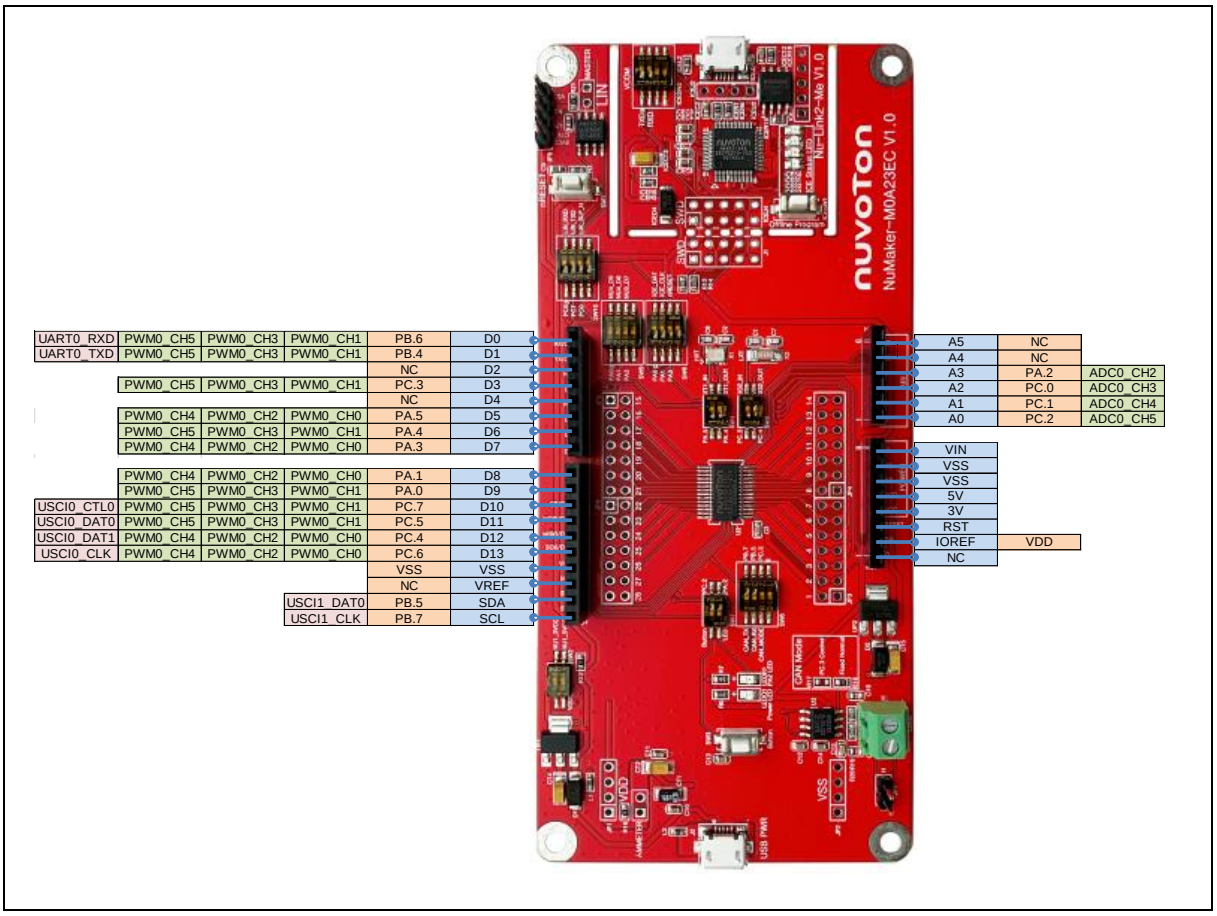


Figure 3-4 Arduino UNO Compatible Extension Connectors

Header		NuMaker-M0A23EC		Header		NuMaker-M0A23EC	
		Compatible to Arduino UNO	GPIO Pin of M0A23EC1AC			Compatible to Arduino UNO	GPIO Pin of M0A23EC1AC
NU3	NU3.1	D0	PB.6	NU2	NU2.6	A5	NC
	NU3.2	D1	PB.4		NU2.5	A4	NC
	NU3.3	D2	NC		NU2.4	A3	PA.2
	NU3.4	D3	PC.3		NU2.3	A2	PC.0
	NU3.5	D4	NC		NU2.2	A1	PC.1
	NU3.6	D5	PA.5		NU2.1	A0	PC.2
	NU3.7	D6	PA.4	NU1	NU1.8	VIN	-
	NU3.8	D7	PA.3		NU1.7	VSS	
NU4	NU4.1	D8	PA.1		NU1.6	VSS	
	NU4.2	D9	PA.0		NU1.5	5V	
	NU4.3	D10	PC.7		NU1.4	3V	
	NU4.4	D11	PC.5		NU1.3	RST	nRESET
	NU4.5	D12	PC.4		NU1.2	IOREF	V_{REF}
	NU4.6	D13	PC.6		NU1.1	NC	-
	NU4.7	VSS	V_{SS}				
	NU4.8	VREF	NC				
	NU4.9	SDA	PB.5				
	NU4.10	SCL	PB.7				

Table 3-3 Arduino UNO Extension Connectors and M0A23EC1AC Mapping GPIO List

3.4 Power Supply Configuration

The NuMaker-M0A23EC 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), 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-M0A23EC.

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 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 3-4 Vin Power Source

3.4.2 5 V Power Sources

Table 3-5 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 M0A21/M0A23 target board and Nu-Link2-Me.
J2	USB_VBUS	USB connector on NuMaker-M0A23EC supplies 5 V power from PC to M0A21/M0A23 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.
JP8	JP8_5VCC	JP8 on NuMaker-M0A23EC supplies 5 V power from LIN bus to M0A21 platform and Nu-Link2-Me.

Table 3-5 5 V Power Sources

3.4.3 3.3 V Power Sources

Table 3-6 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 M0A21/M0A23 target board or ICE chip.
UP1	USB_VBUS	UP1 converts USB_VBUS to 3.3 V and supplies 3.3 V to M0A21/M0A23 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 M0A21/M0A23 target board. **Note:** SW2.2 (NU1 3VCC) should be switched to ON.
UP1	JP8_5VCC	UP1 converts JP8_5VCC to 3.3 V and supplies 3.3 V to M0A21 platform. **Note:** SW2.2 (NU1 3VCC) should be switched to ON.

Table 3-6 3.3 V Power Sources

3.4.4 Power Connectors

Table 3-7 presents the power connectors.

Connector	Description
JP1	V_{DD} connector on the NuMaker-M0A21EC.
JP2	V_{SS} connector on the NuMaker-M0A21EC.

Table 3-7 Power Connectors

3.4.5 USB Connectors

Table 3-8 presents the USB connectors.

Connector	Description
ICEJ3	ICE USB connector on Nu-Link2-Me for power supply, debugging and programming from PC.
J2	USB FS connector on NuMaker-M0A23EC for power supply.

Table 3-8 USB Connectors

3.4.6 Power Switches

Table 3-9 presents the power switches.

Switch	Description
ICEJPR1	Configures the target chip operating voltage at 1.8 V / 3.3 V / 5 V. **Note:** M0A21 operating voltage range is from 2.4 V to 5.5 V. Do not switch ICEJPR1 (MCUVCC) to 1.8 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 3-9 Power Switches

3.4.7 Power Supply Models

3.4.7.1 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.

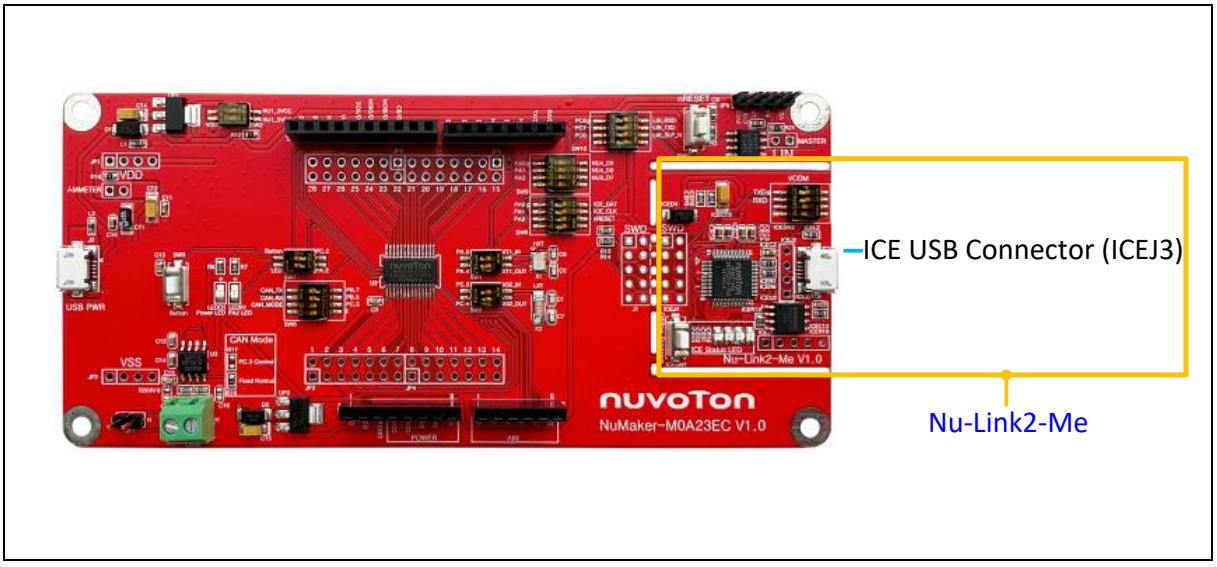


Figure 3-5 External Power Supply Sources on Nu-Link2-Me

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 3-10 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	3.3 V	Connect to PC	3.3 V (default)	3.3 V (default)	3.3 V	Off	-	-	3.3 V output
2	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 3.3 V / 5 V.
2. 0 Ω should be soldered between ICEJPR2's ICEVCC and 3.3 V.
3. -: Unused.

Table 3-10 Supply External Power through Nu-Link2-Me

3.4.7.2 External Power Supply through M0A21/M0A23 Target Board to Target Chip

The external power supply sources on M0A21/M0A23 target board are shown in Figure 3-6.

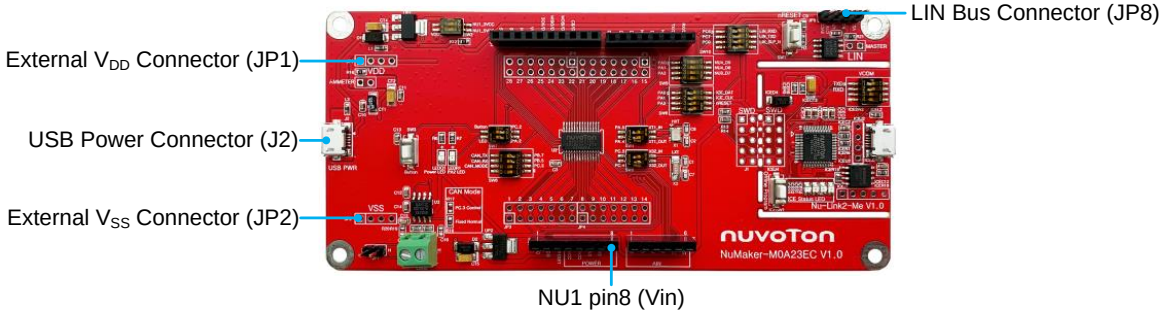


Figure 3-6 External Power Supply Sources on M0A21/M0A23 Target Board

To use Vin, J2 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, J2 or J8.

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, J2 or JP8 as external power supply source with Nu-Link2-Me detached from NuMaker-M0A23EC, please follow the steps below:

1. Switch the SW2 depending on the target chip operating voltage.
2. Detach the Nu-Link2-Me from NuMaker-M0A23EC.
3. Connect the external power supply to Vin, J2 or JP8.

To use JP1 as external power supply source with Nu-Link2-Me detached from NuMaker-M0A23EC, please follow the steps below:

1. Switch the SW2 to OFF.
2. Detach the Nu-Link2-Me from NuMaker-M0A23EC.
3. Connect the external power supply to JP1.

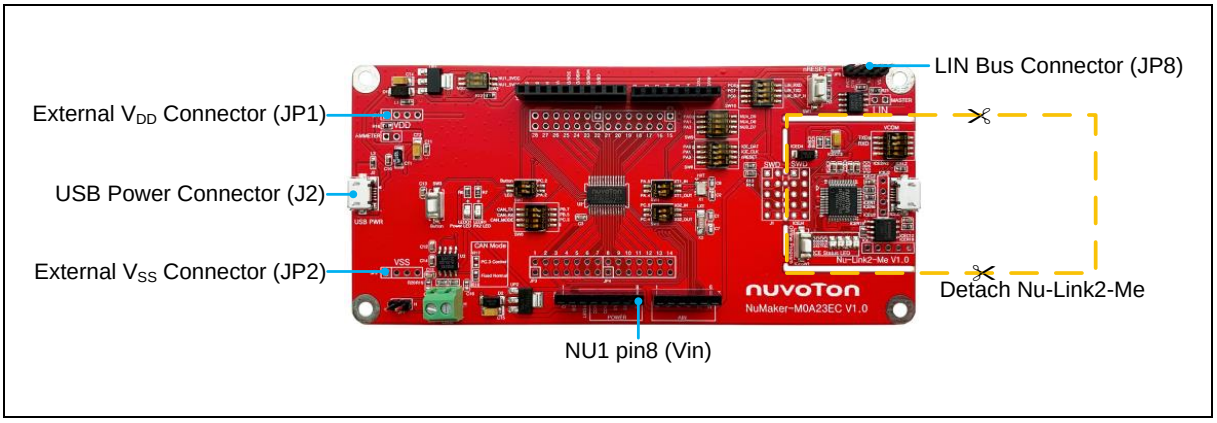


Figure 3-7 Detach the Nu-Link2-Me from NuMaker-M0A23EC

Table 3-11 presents all power models when supplies external power through M0A21/M0A23 target board. The M0A21/M0A23 target board external power sources are highlighted in yellow.

Model	Target Chip Voltage	Vin [1]	J2[1]	JP8[1]	ICEJ3	SW2 Selection	JP1[2]	ICEJPR1 (MCUVCC) Selection [3]	ICEJPR2 (ICEVCC) Selection [4]	ICE Chip Voltage [5]
3	3.3 V	7 V ~ 12 V Input	-	-	-	NU1 3VCC	3.3 V output	Remove resistor	3.3 V	3.3 V
4	3.3 V	-	Connect to PC	-	-	NU1 3VCC	3.3 V output	Remove resistor	3.3 V	3.3 V
5	3.3 V	-	-	Connect to LIN bus	-	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	5 V	-	-	Connect to LIN bus	-	NU1 5VCC	5 V output	Remove resistor	3.3 V	3.3 V
9	2.4 V ~ 5.5 V	-	-	-	Connect to PC	OFF	DC Input 2.4 V ~ 5.5 V	Remove resistor	1.8 V / 3.3 V	1.8 V / 3.3 V
10	2.4 V ~ 5.5 V	-	-	-	Nu-Link2-Me removed	OFF	DC Input 2.4 V ~ 5.5 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 3-11 Supply External Power for M0A21/M0A23 Target Board

3.5 Ammeter Connector

Table 3-12 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 3-12 Ammeter Connector

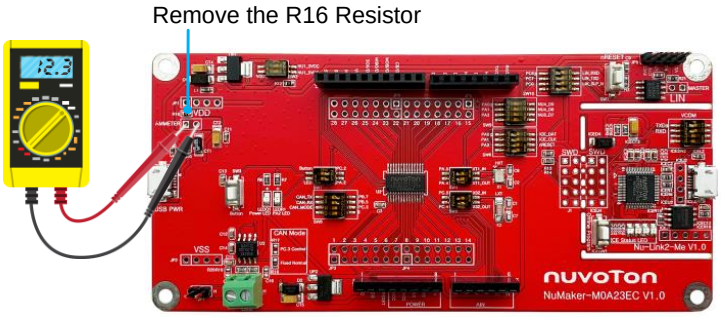


Figure 3-8 Wiring between Ammeter Connector and Ammeter

3.6 Function Switches

Table 3-13 presents the function switches.

Component	Description
SW4	Switch both SW4.1 and SW4.2 to ON to enable PA.4 and PA.5 to external 12 MHz crystal.
SW5	Switch both SW5.1 and SW5.2 to ON to enable PC.4 and PC.5 to external 32.768 kHz crystal.
SW6	Switch both SW6.3 and SW6.4 to ON to enable PB.5 and PB.7 to CAN transceiver. Switch SW6.2 to ON to enable PC.3 to control CAN mode.
SW7	Switch SW7.1 to ON to enable PA.2 to LEDR1. Switch SW7.2 to ON to enable PC.2 to Button (SW3).
SW8	Switch SW8.1, SW8.2 and SW8.3 to ON to enable PA.0, PA.1 and PA.3 to SWD interface (ICE_DAT, ICE_CLK and nRESET). **Note:** Do not switch SW9 at the same time for safety.
SW9	Switch SW9.1, SW9.2 and SW9.3 to ON to enable PA.0, PA.1 and PA.3 to Arduino interface (D7 ~ D9). **Note:** Do not switch SW8 at the same time for safety.

SW10	Switch both SW10.1 and SW10.2 to ON to enable PC.6 and PC.7 to LIN transceiver. Switch SW10.3 to ON to enable PC.0 to control LIN mode.

Table 3-13 Function Switches

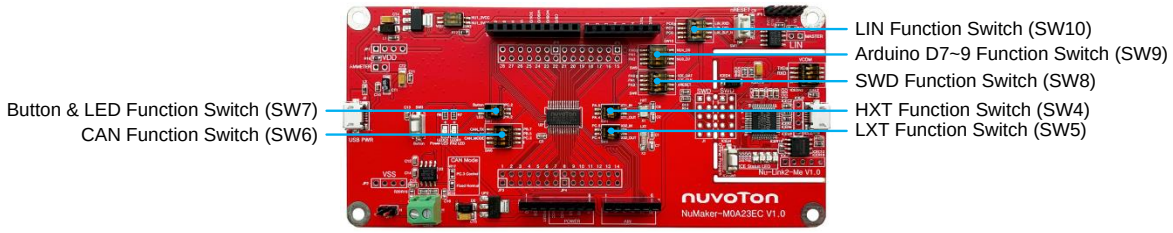


Figure 3-9 Function Switches on NuMaker-M0A23EC

3.7 CAN Mode Selection

Table 3-14 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	SW6.3	SW6.4	SW6.2
1	Disable	-	-	-	OFF	OFF	OFF
2	Normal	0 Ω	-	-	ON	ON	OFF
3	Normal	-	0 Ω	Low	ON	ON	ON
4	Silent	-	0 Ω	High	ON	ON	ON
Note: -: Unused.							

Table 3-14 Operating Mode of CAN Transceiver

3.8 LIN Mode Selection

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

Model	LIN Operating Mode	R21	MASTER	PC.0	SW10.1	SW10.2	SW10.3
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 3-15 Operating Mode of LIN Transceiver

3.9 Push Buttons

Table 3-16 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.
SW3	Customize button is connected to the M0A23OC1AC PC.2 if SW7.2 switches to ON.

Table 3-16 Push-Buttons

3.10 LEDs

Table 3-17 presents the LEDs.

Component	Description
Power LED	The power LED indicates that the NuMaker-M0A23EC is powered.
PB14 LED	The LED is connected to the target chip PA.2 if SW7.1 switches to ON.
ICES0, ICES1, ICES2 and ICES3	Nu-Link2-Me status LED.

Table 3-17 LEDs

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 3-18 presents how to set the VCOM function by ICESW2.

ICESW2		
Pin	**Function**	**Description**
1	TXD	**On**: Connect target chip PB.4 (UART0_TXD) to Nu-Link2-Me. **Off**: Disconnect target chip PB.4 (UART0_TXD) to Nu-Link2-Me.
2	RXD	**On**: Connect target chip PB.6 (UART0_RXD) to Nu-Link2-Me. **Off**: Disconnect target chip PB.6 (UART0_RXD) to Nu-Link2-Me.
Note: Pin 3 and 4 is unused.		

Table 3-18 VCOM Function of Nu-Link2-Me

3.11.2 Status LEDs

Table 3-17 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 3-19 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.

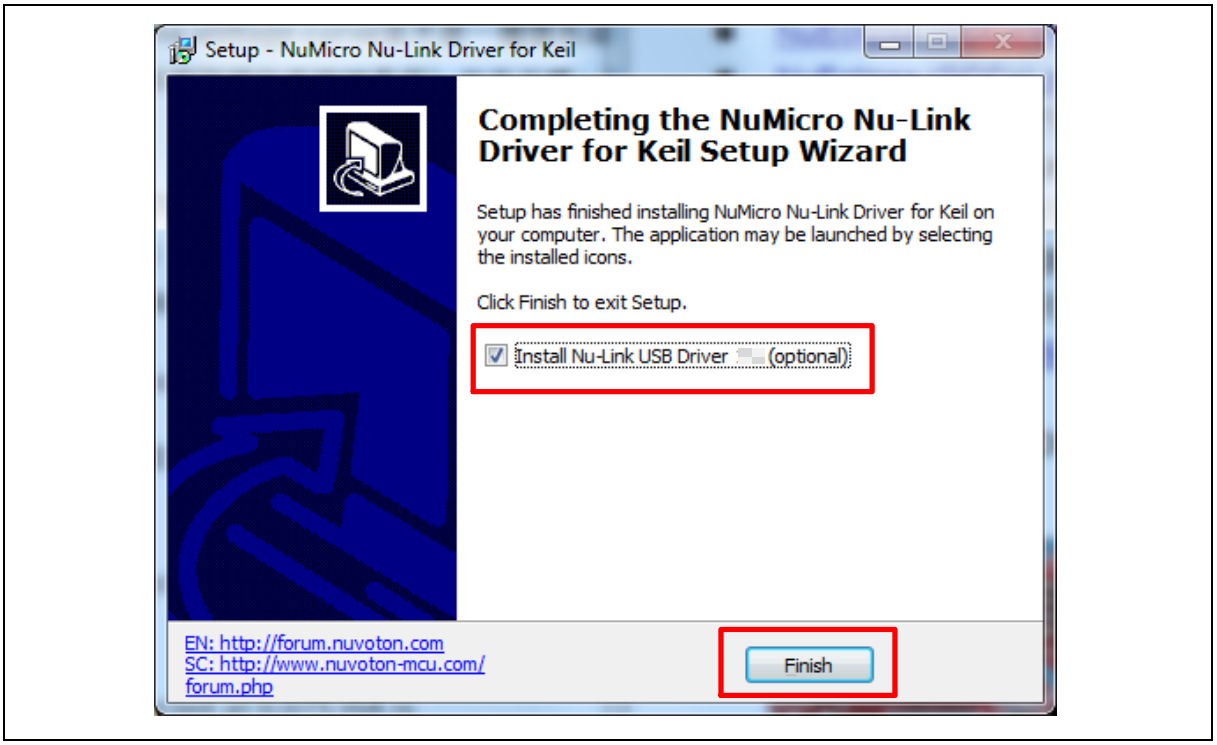


Figure 4-1 Nu-Link USB Driver Installation Setup

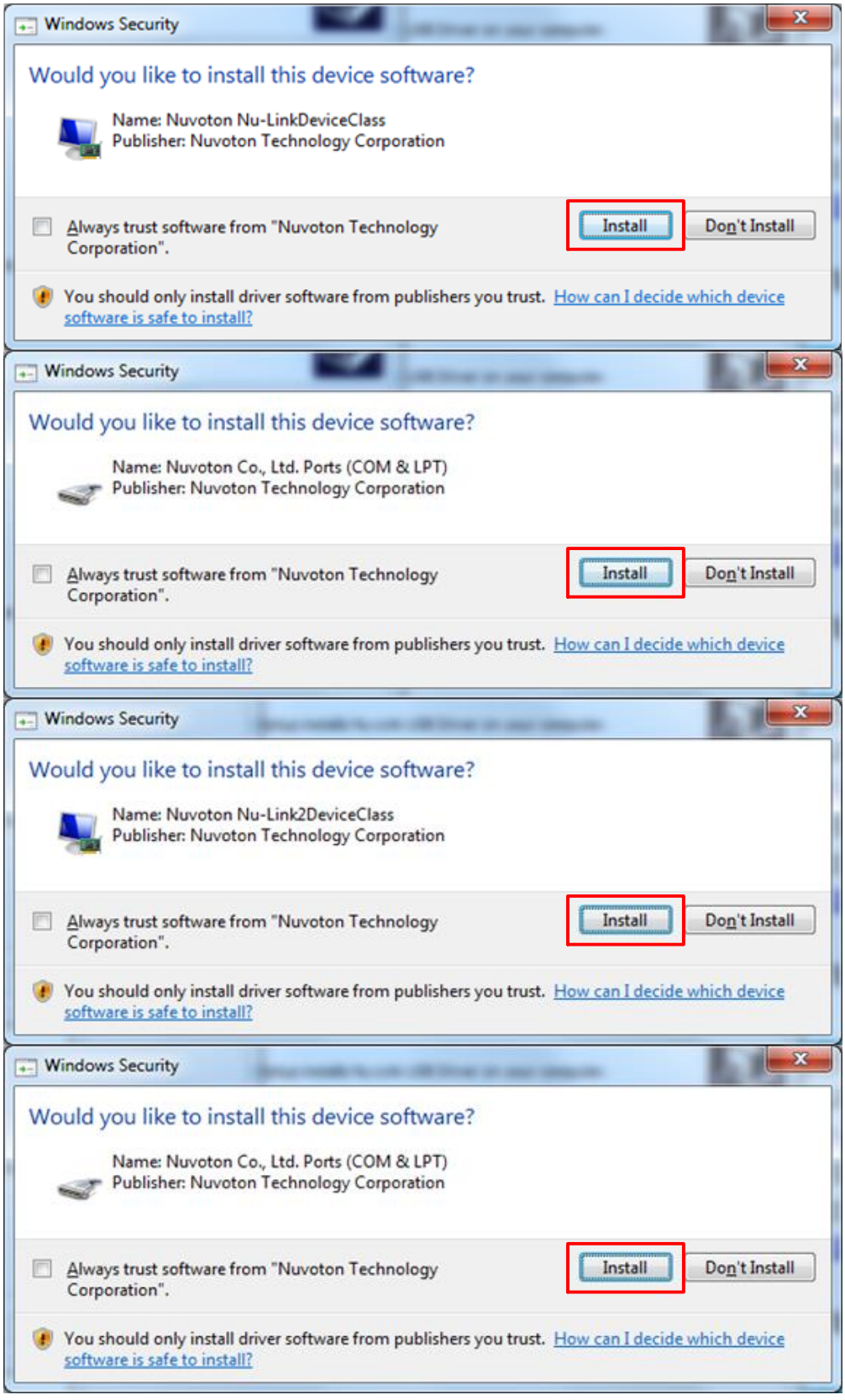


Figure 4-2 Nu-Link USB Driver Installation

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.

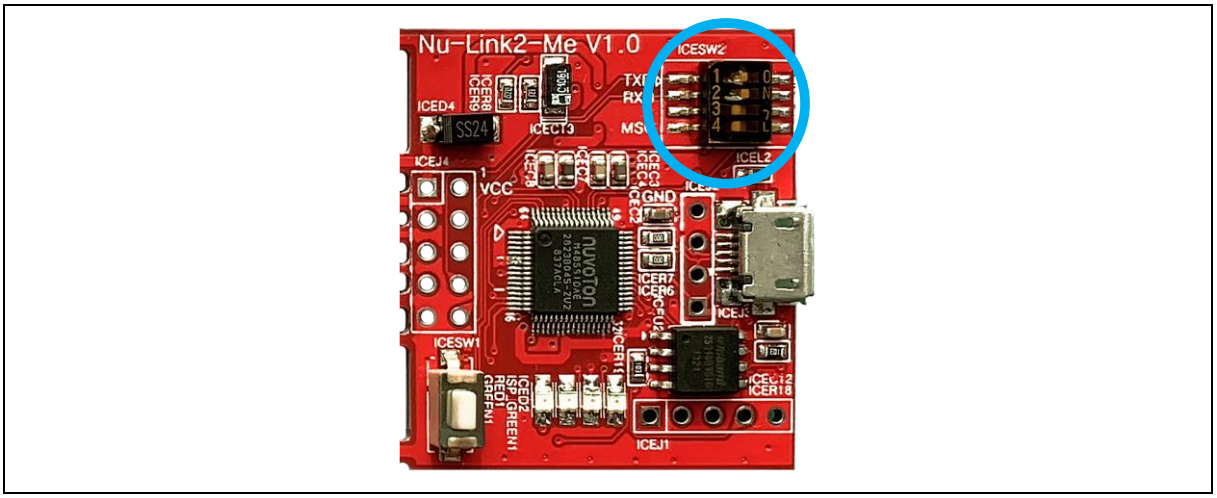


Figure 4-3 Open VCOM Function

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

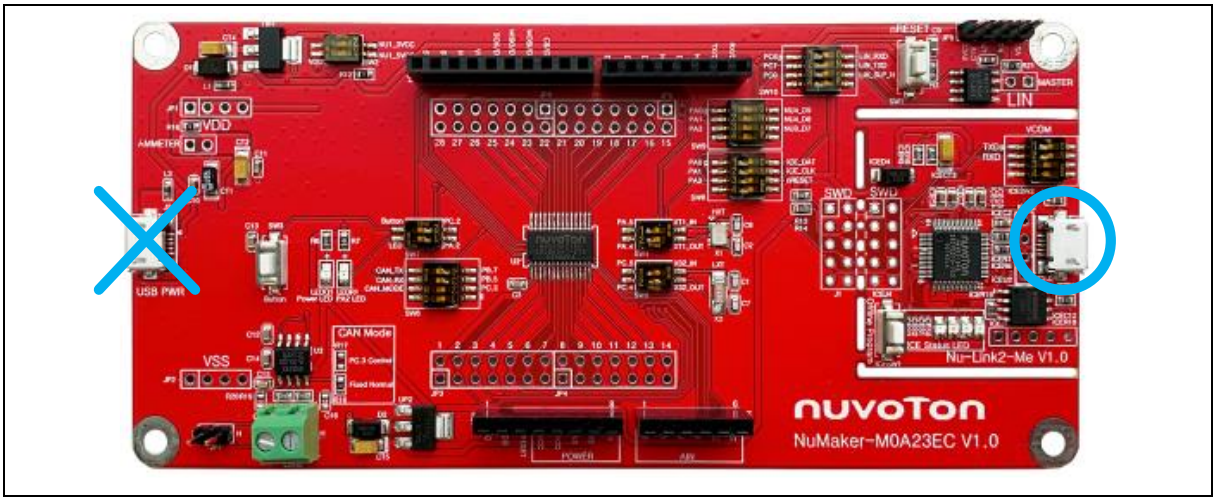


Figure 4-4 ICE USB Connector

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

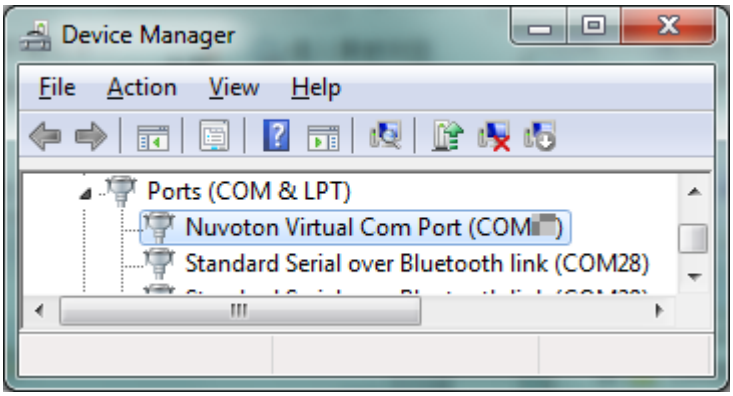


Figure 4-5 Device Manger

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.

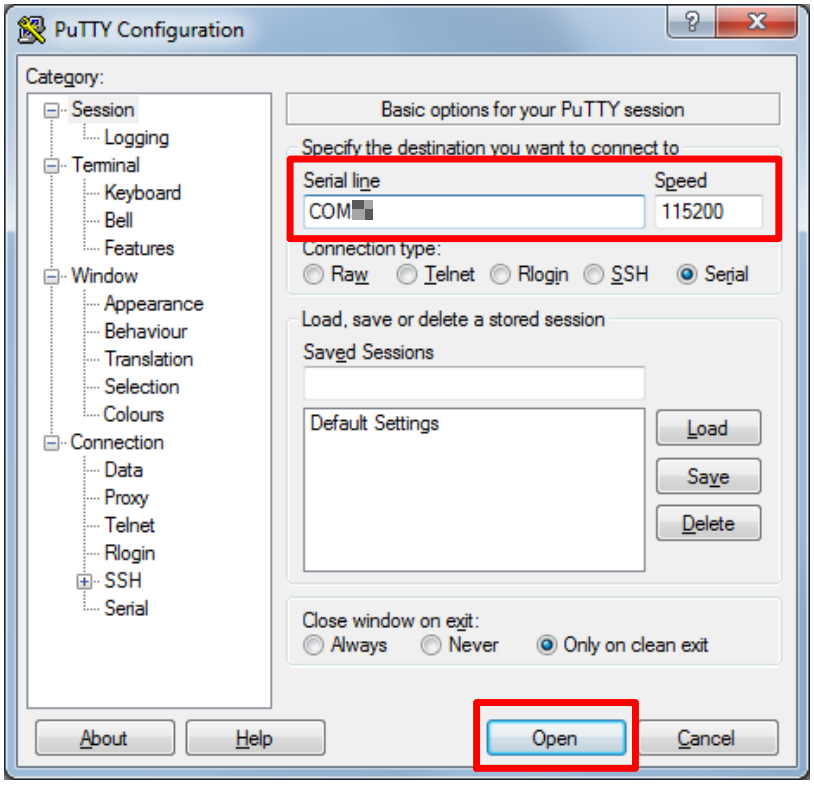


Figure 4-6 PuTTY Session Setting

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.

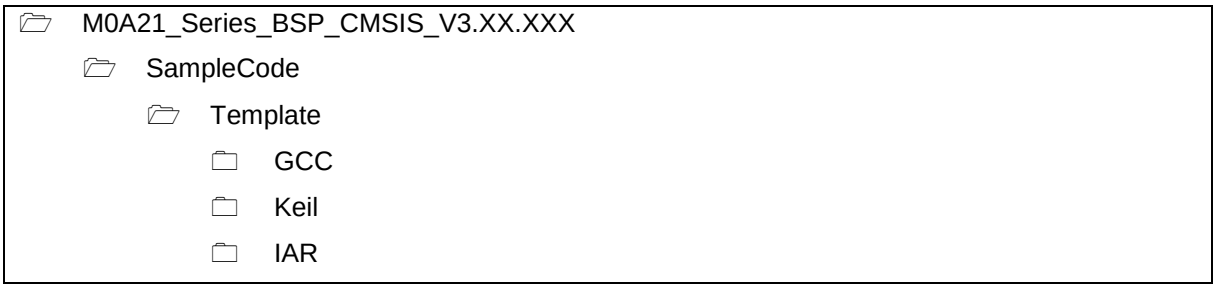


Figure 4-7 Template Project Folder Path

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.

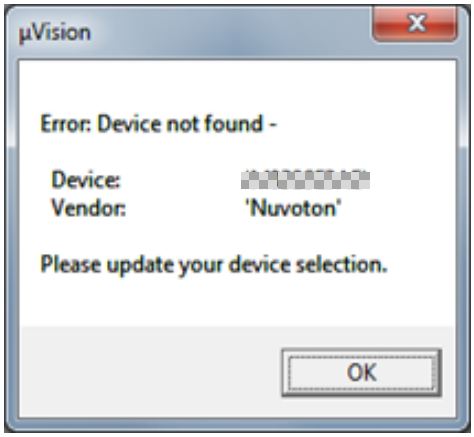


Figure 4-8 Warning Message of “Device not found”

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”.

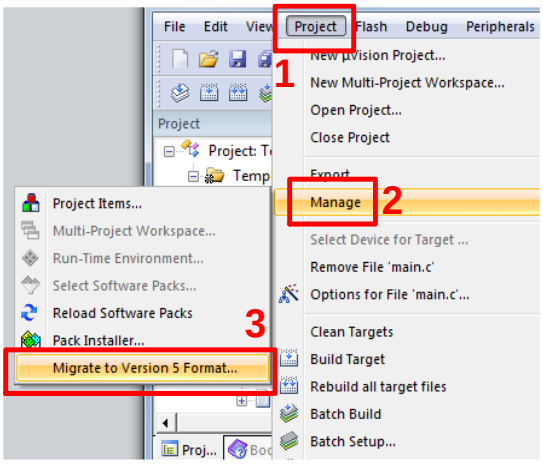


Figure 4-9 Project File Migrate to Version 5 Format

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

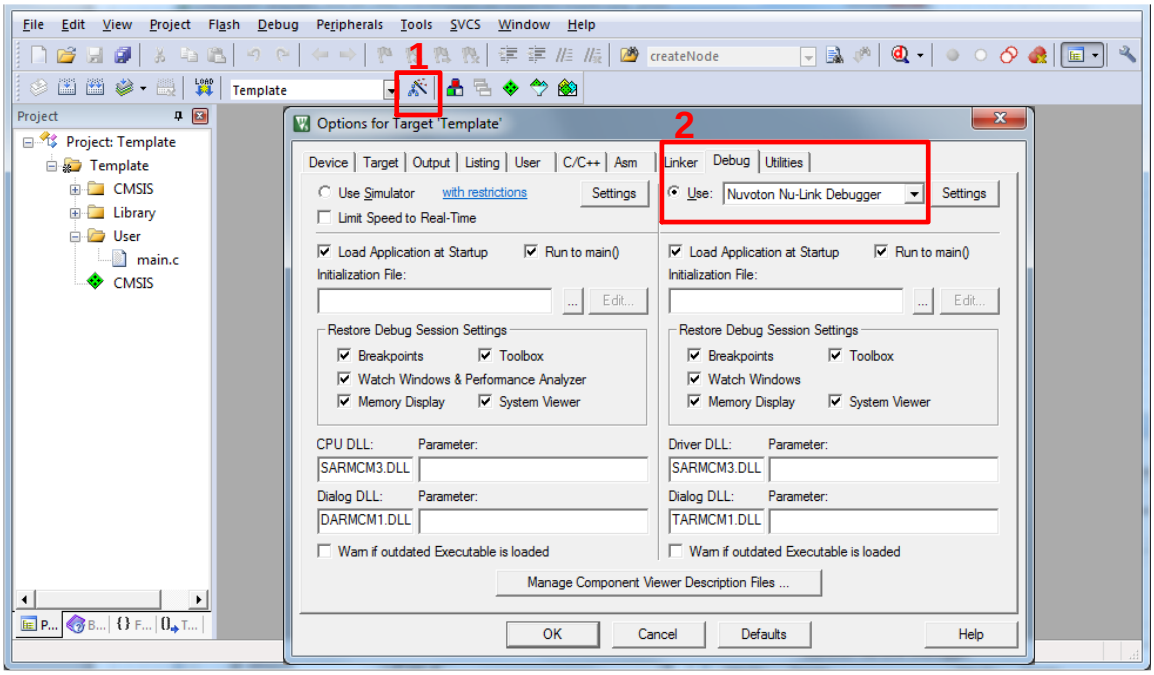


Figure 4-10 Debugger Setting in Options Window

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

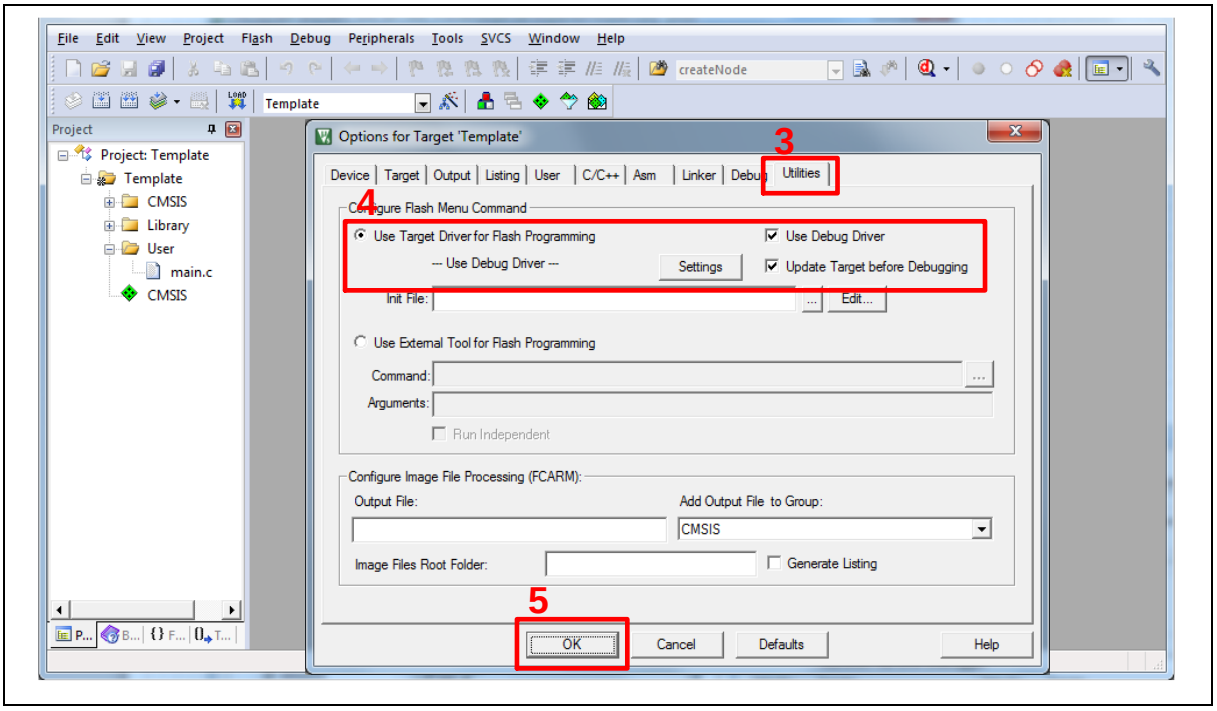


Figure 4-11 Programming Setting in Options Window

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.

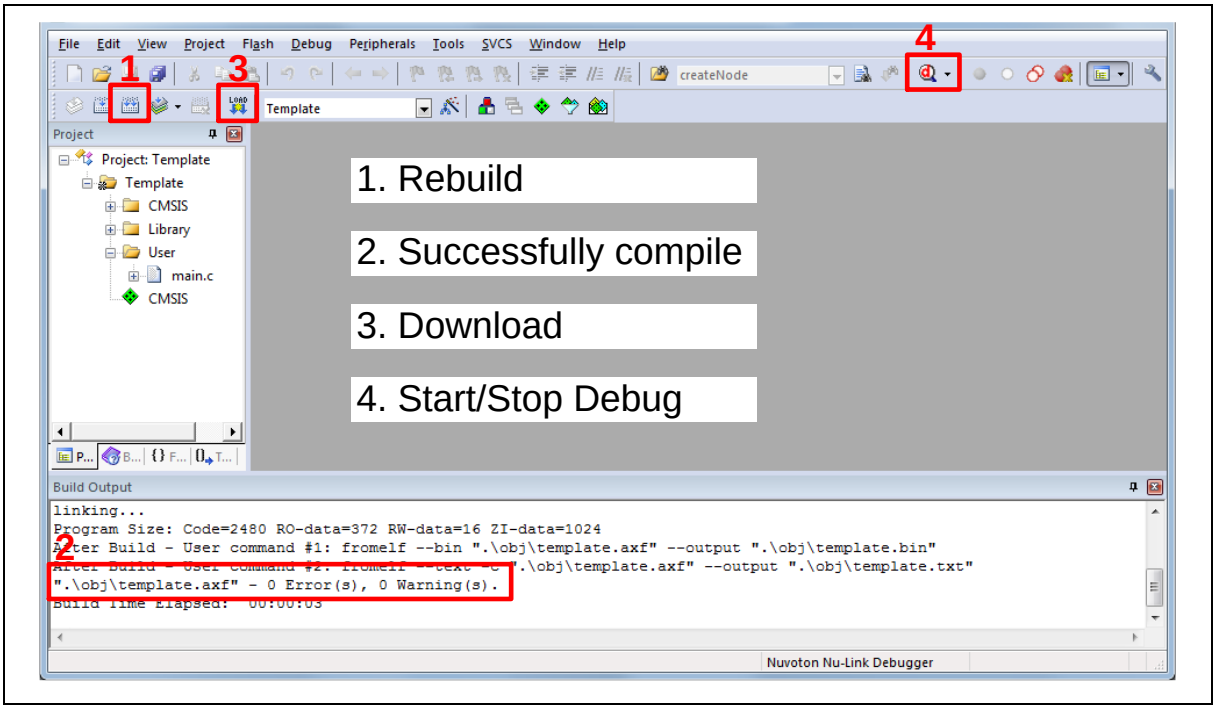


Figure 4-12 Compile and Download the Project

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.

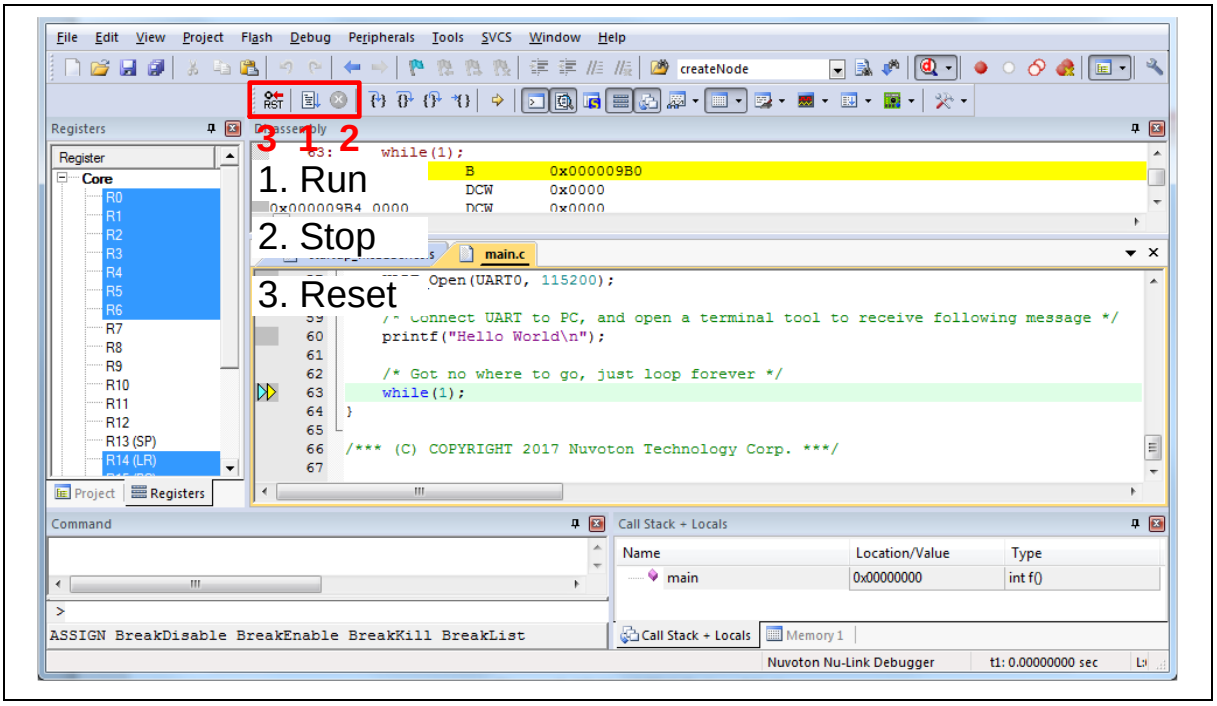


Figure 4-13 Keil MDK Debug Mode

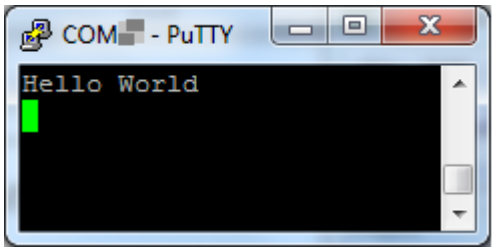


Figure 4-14 Debug Message on Serial Port Terminal Windows

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.

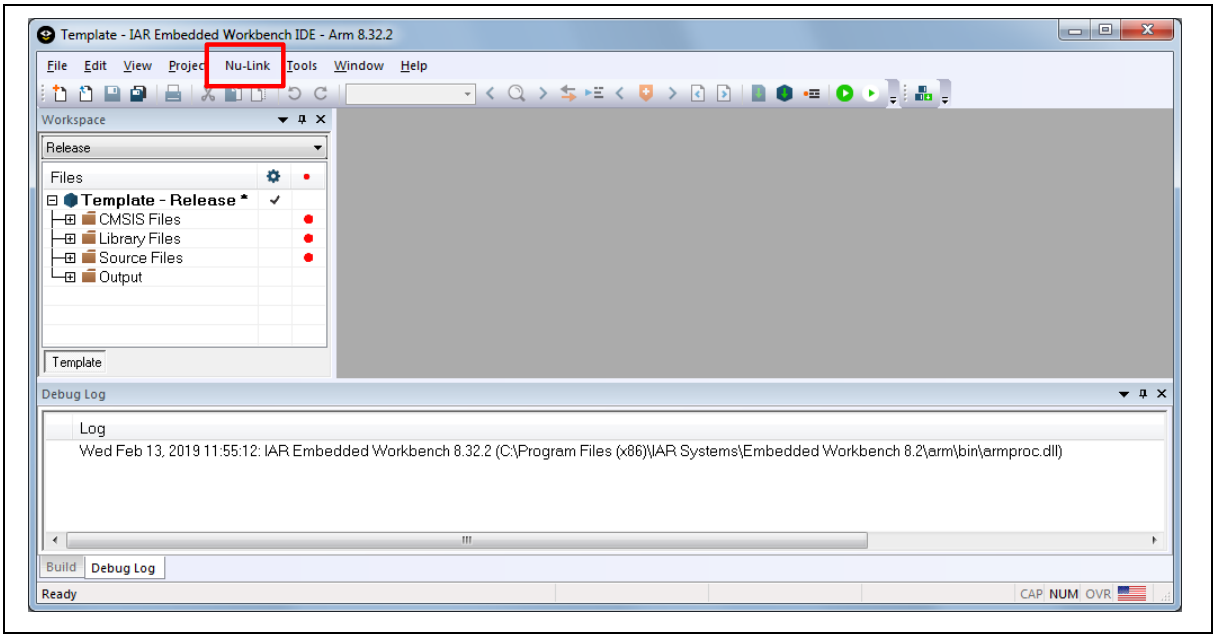


Figure 4-15 IAR EWARM Window

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.

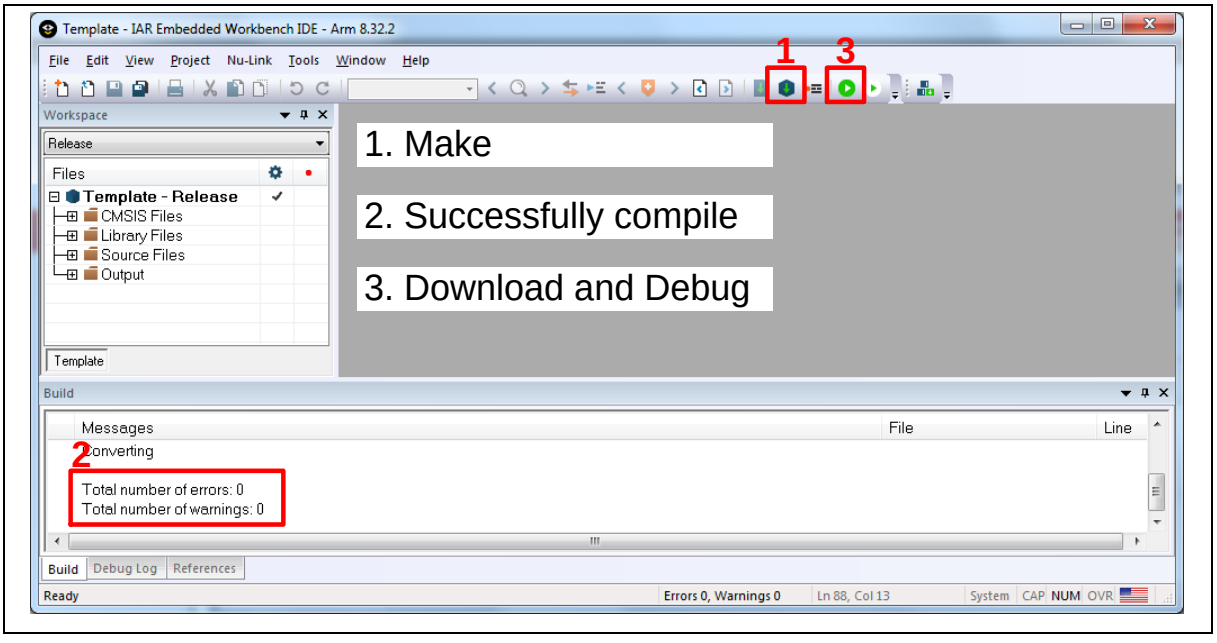


Figure 4-16 Compile and Download the Project

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.

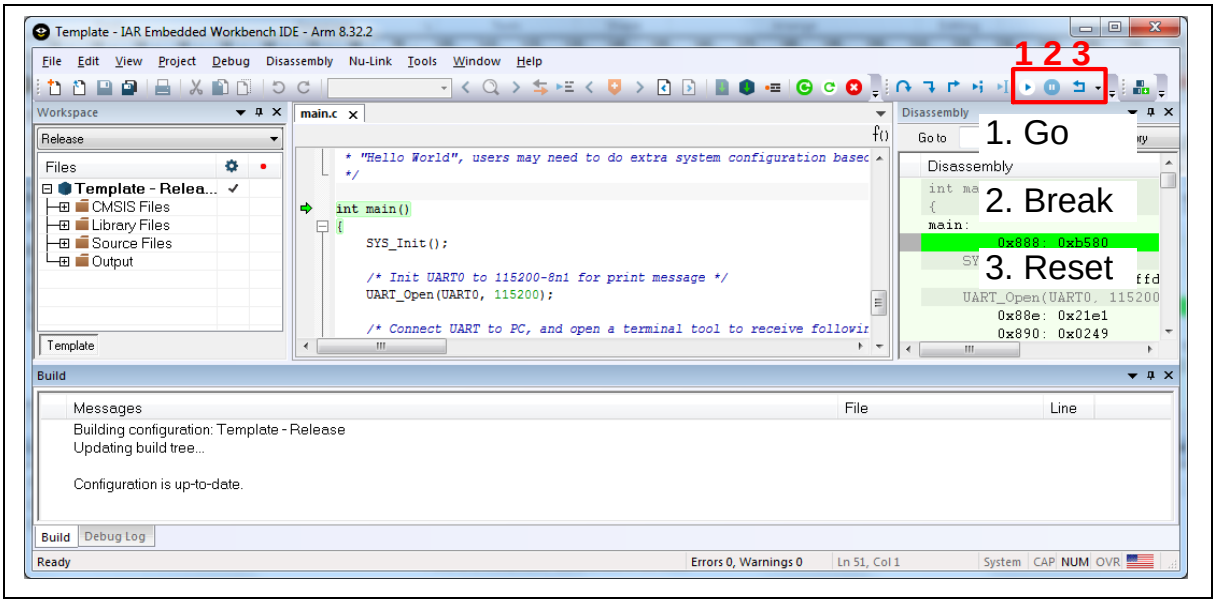


Figure 4-17 IAR EWARM Debug Mode

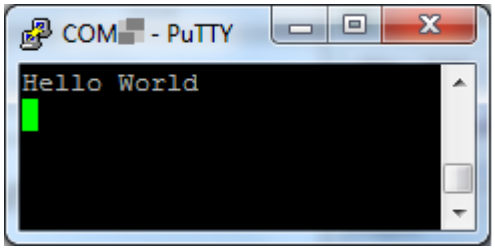


Figure 4-18 Debug Message on Serial Port Terminal Windows

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.

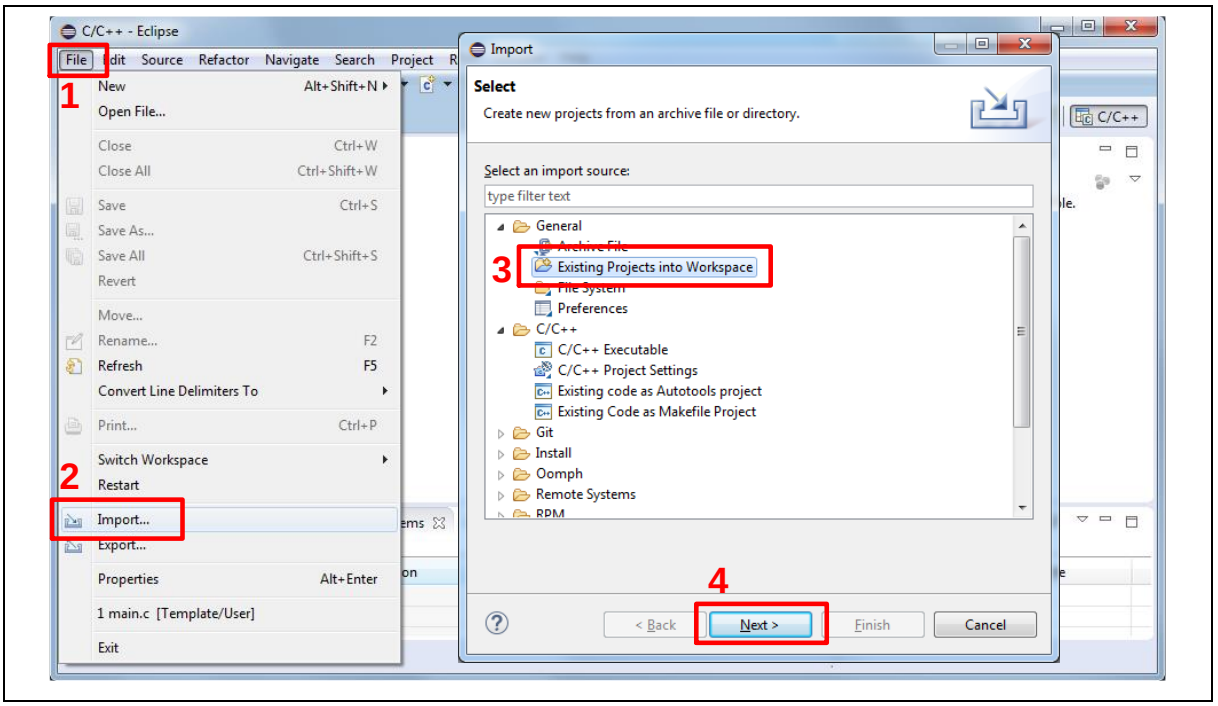


Figure 4-19 Import the Project in NuEclipse

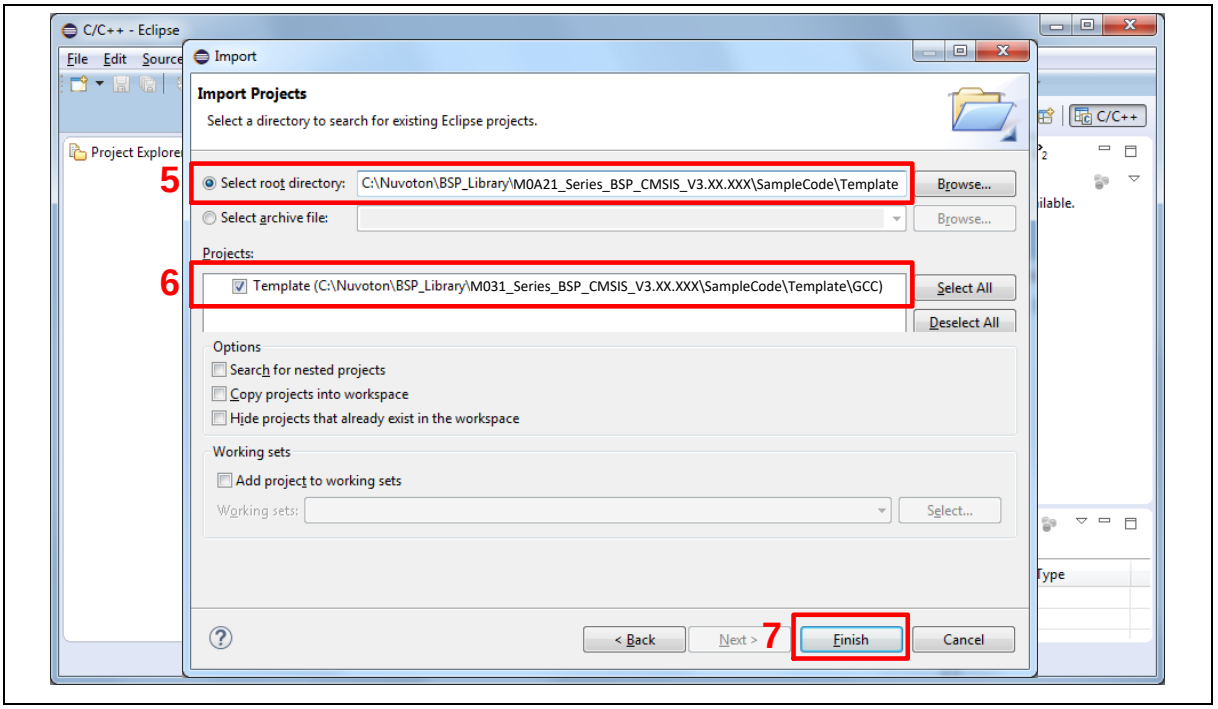


Figure 4-20 Import Projects Windows

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.

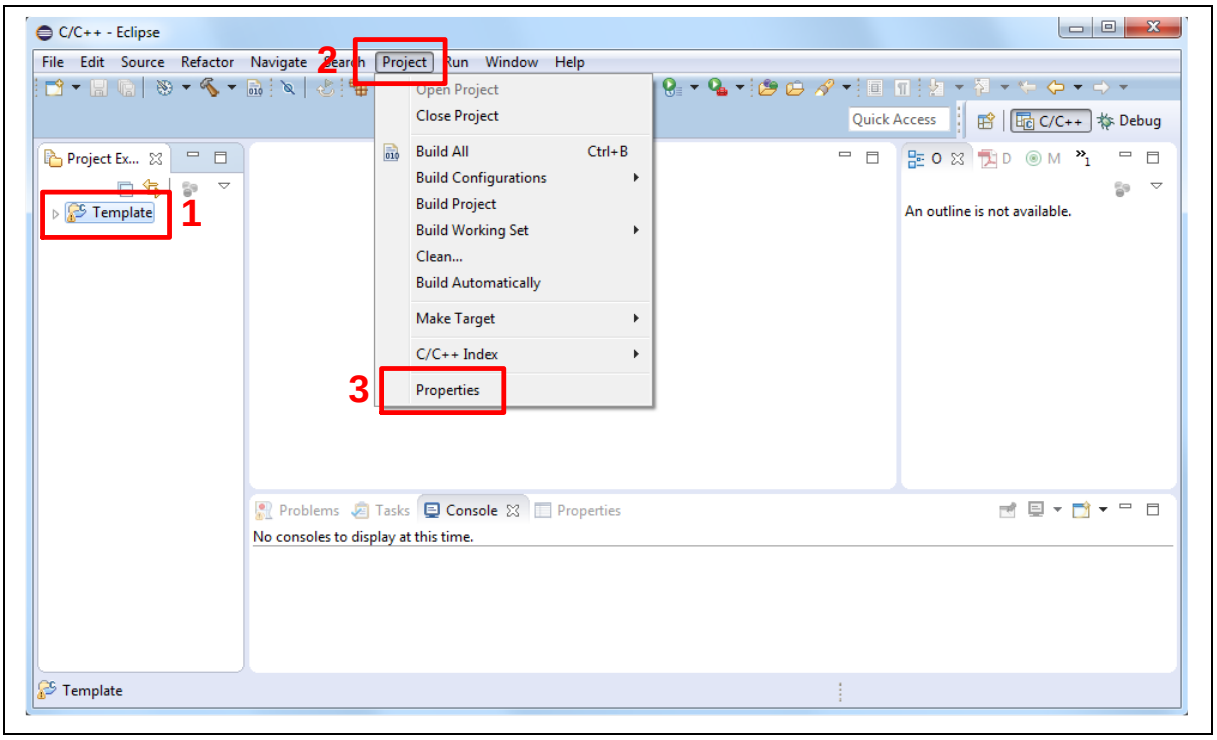


Figure 4-21 Open Project Properties Window

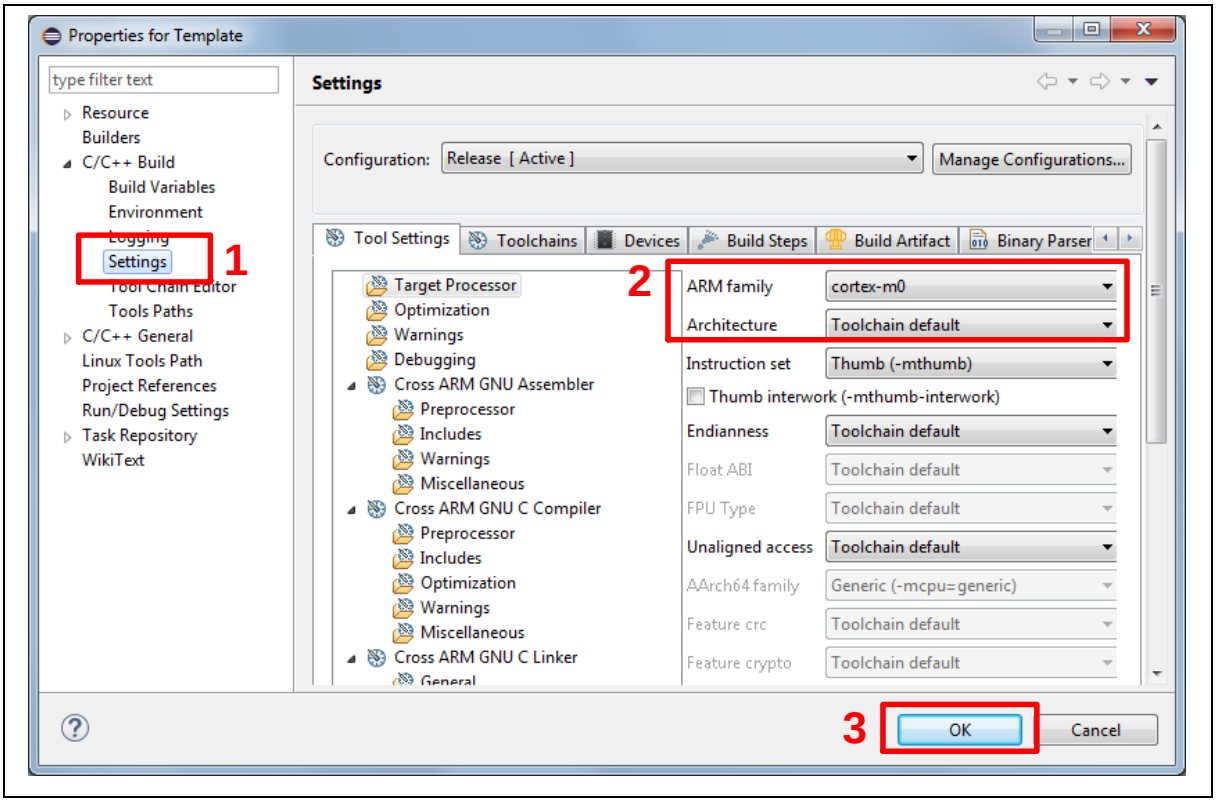


Figure 4-22 Project Properties Settings

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

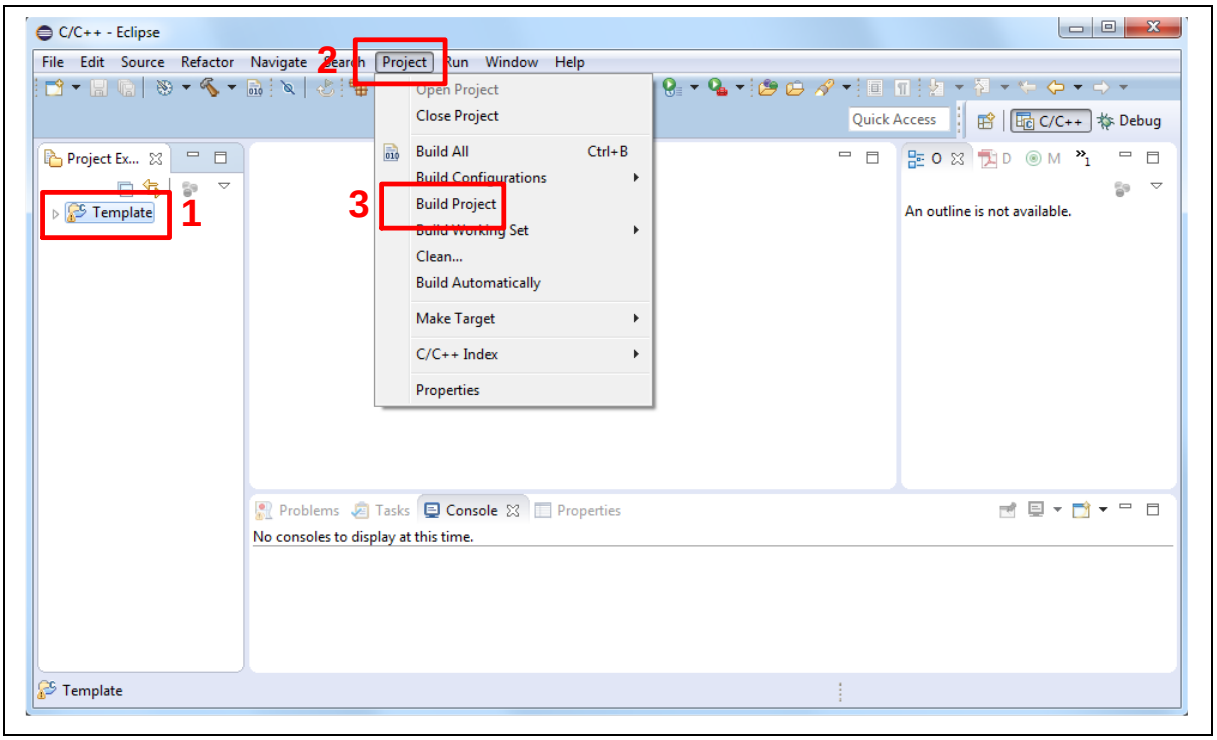


Figure 4-23 Build Project

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.

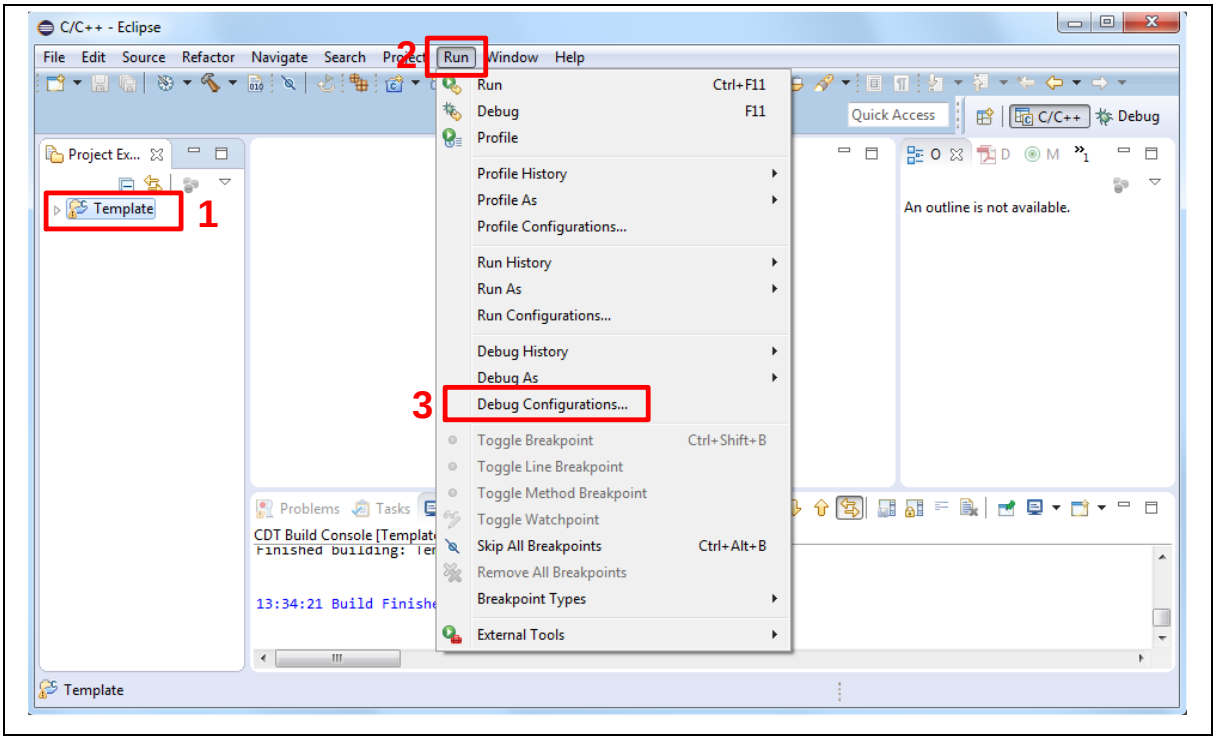
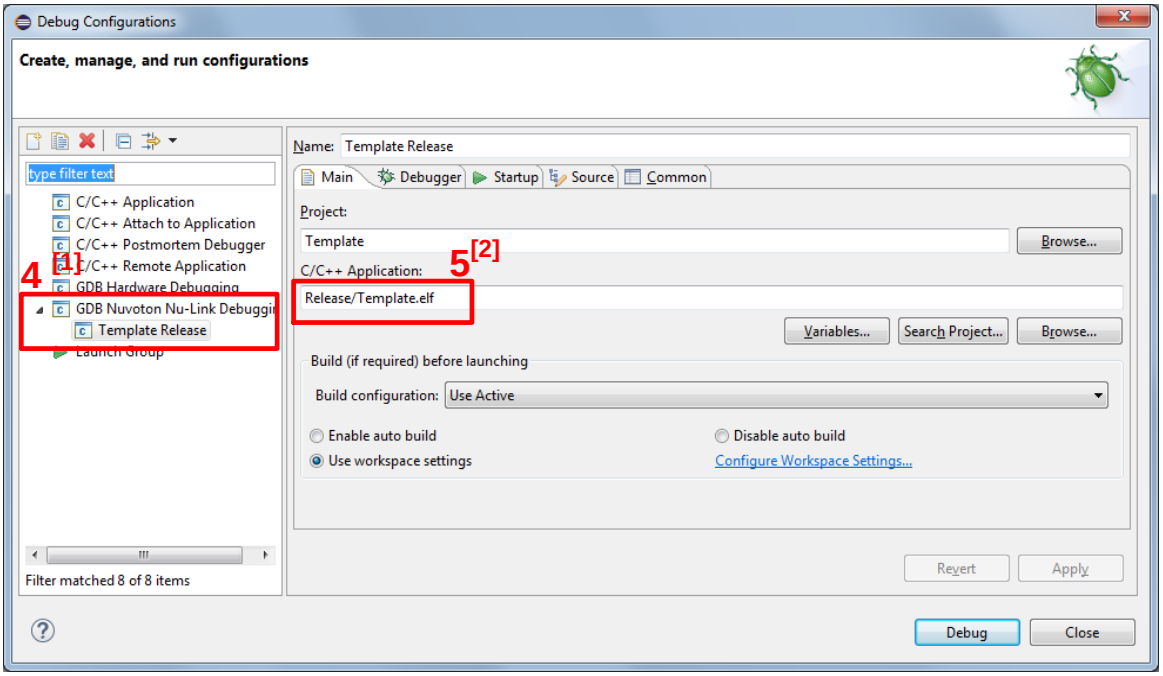


Figure 4-24 Open Debug Configuration



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

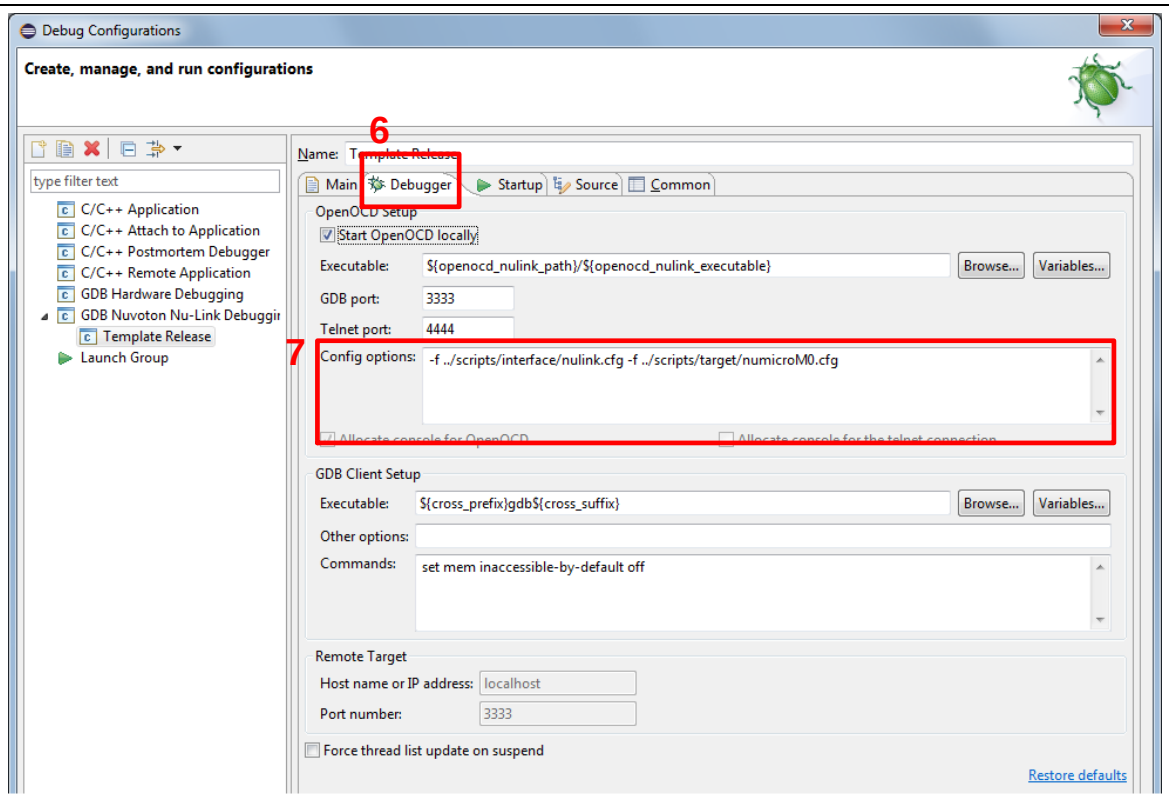
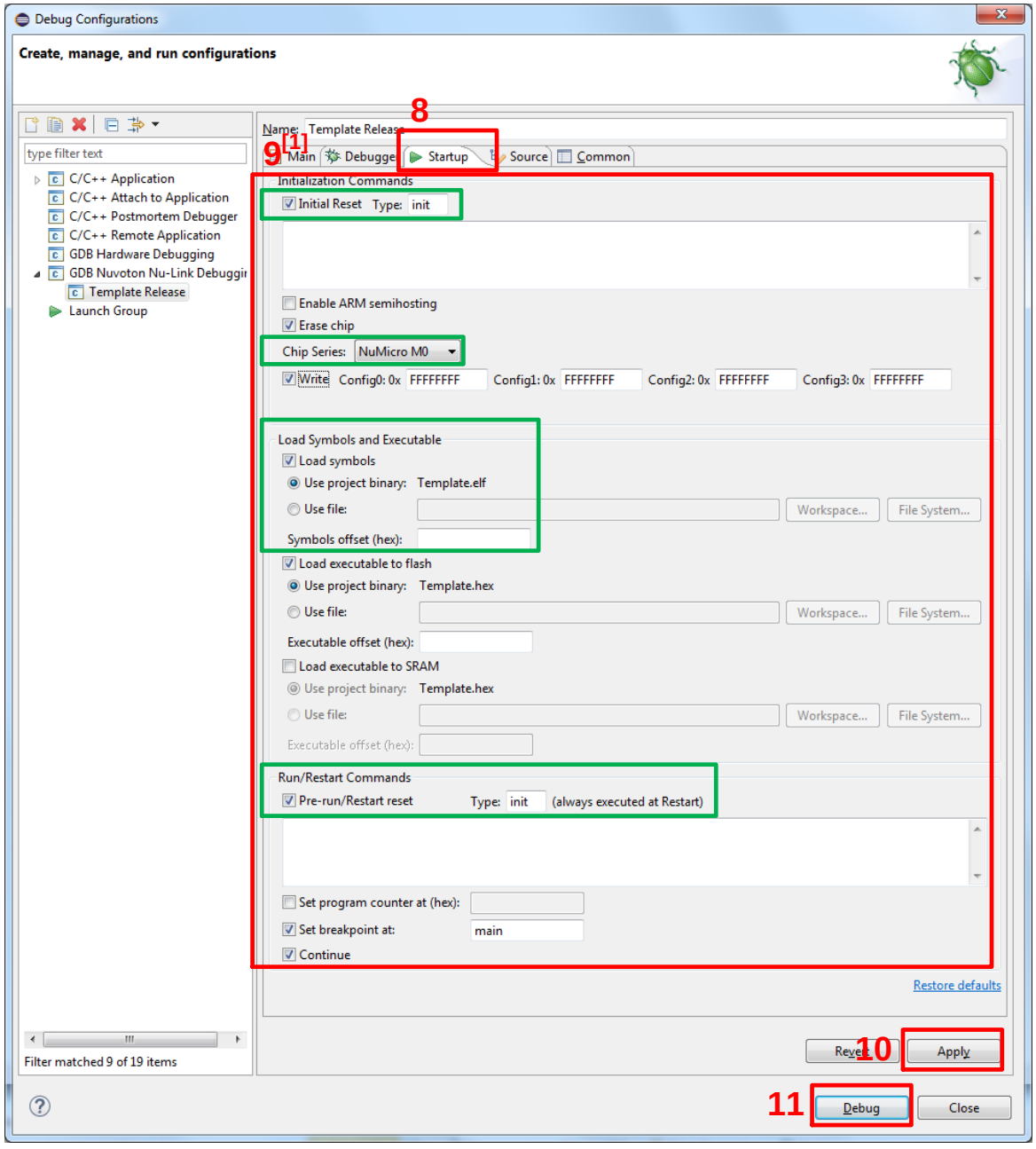


Figure 4-26 Debugger Tab Configuration



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*.

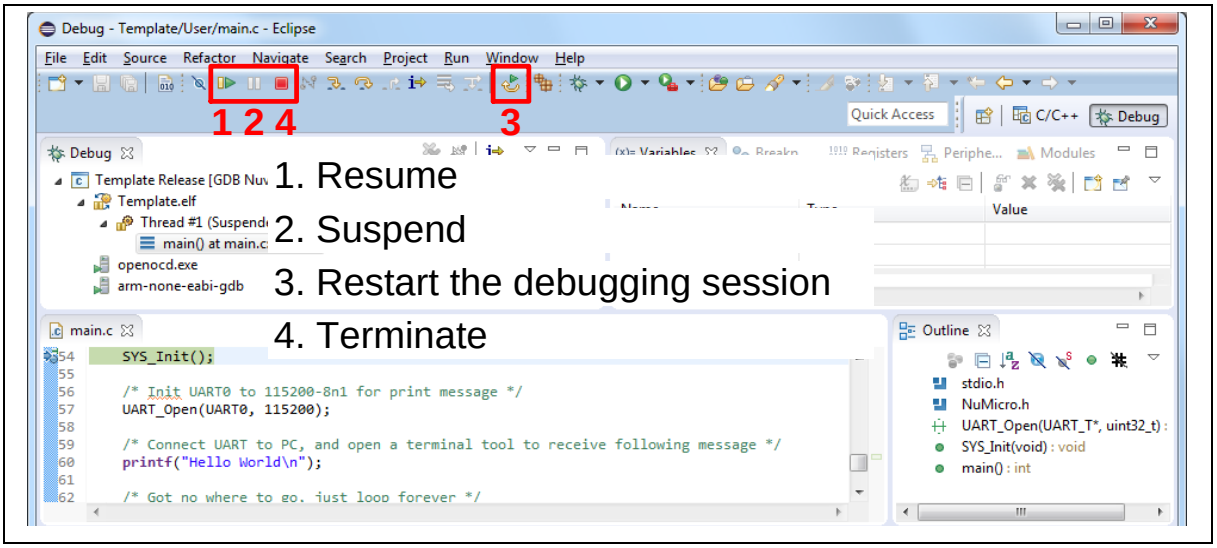


Figure 4-28 NuEclipse Debug Mode

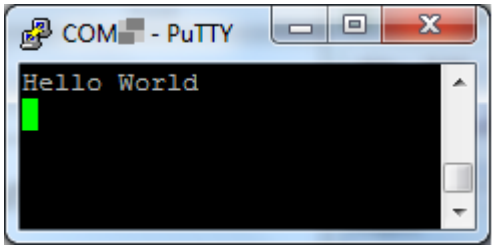


Figure 4-29 Debug Message on Serial Port Terminal Windows

5 NUMAKER-M0A23EC SCHEMATICS

5.1 Nu-Link2-Me

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

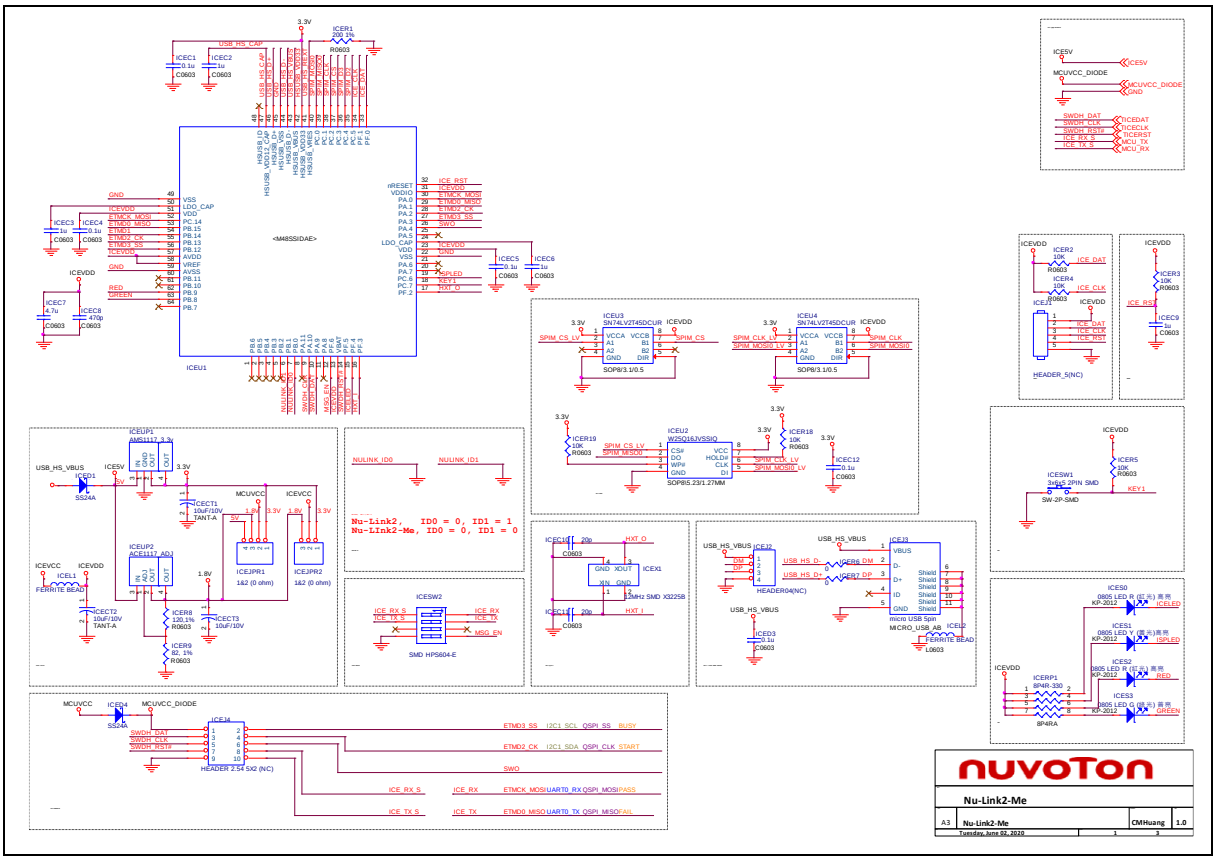


Figure 5-1 Nu-Link2-Me Circuit

5.2 M0A21/M0A23 Target Board

Figure 5-2 shows the M0A21/M0A23 target board circuit.

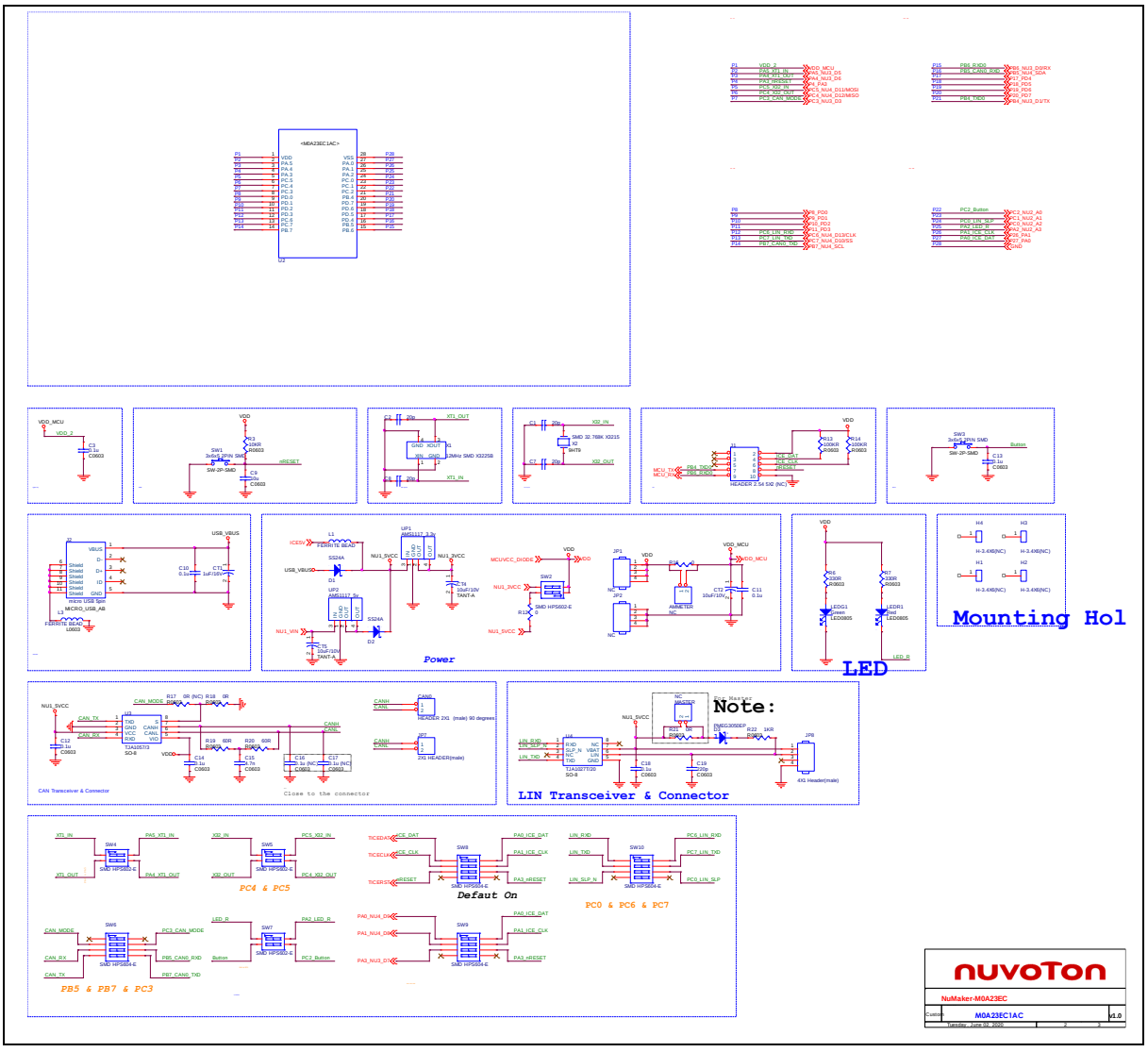


Figure 5-2 M0A21/M0A23 Target Board Circuit

5.3 Extension Connectors

Figure 5-3 shows extension connectors of NuMaker-M0A23EC.

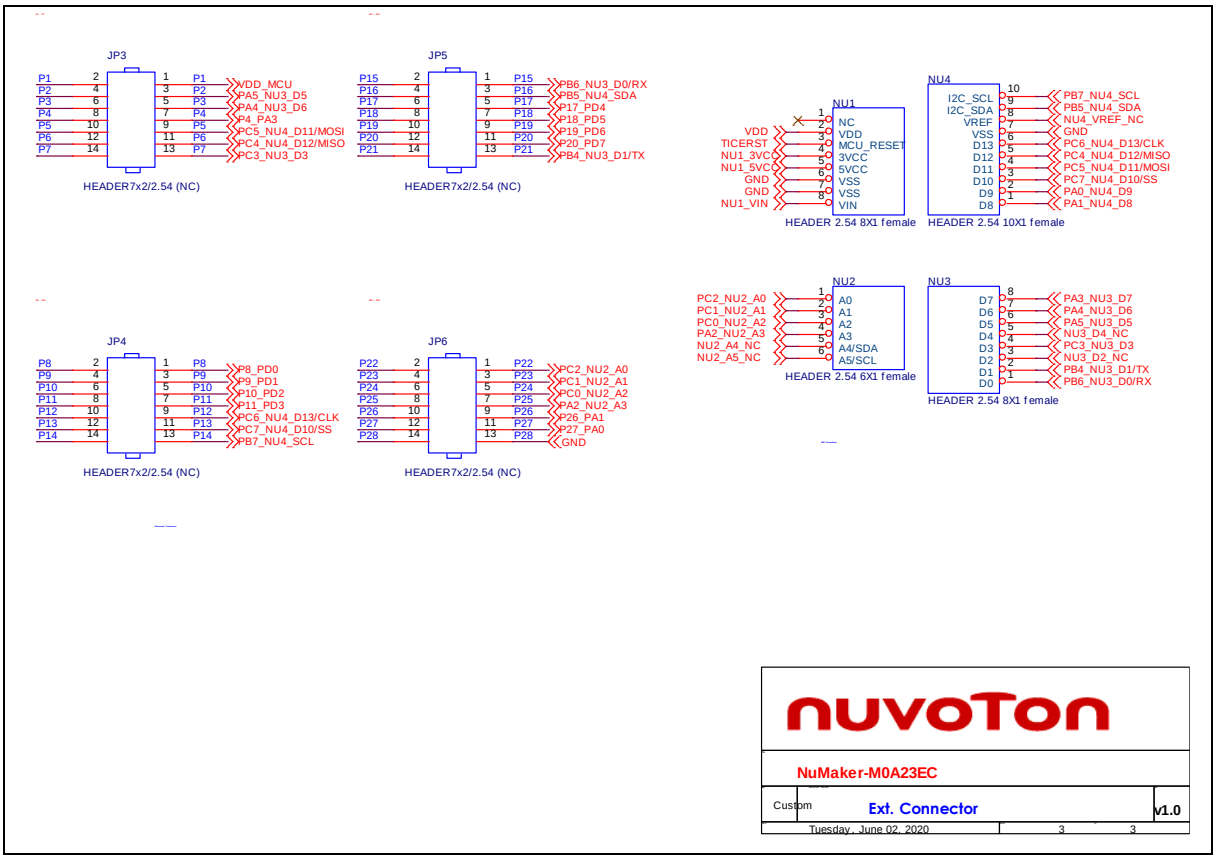


Figure 5-3 Extension Connectors Circuit

5.4 PCB Placement

Figure 5-4 and Figure 5-5 show the front and rear placement of NuMaker-M0A23EC.

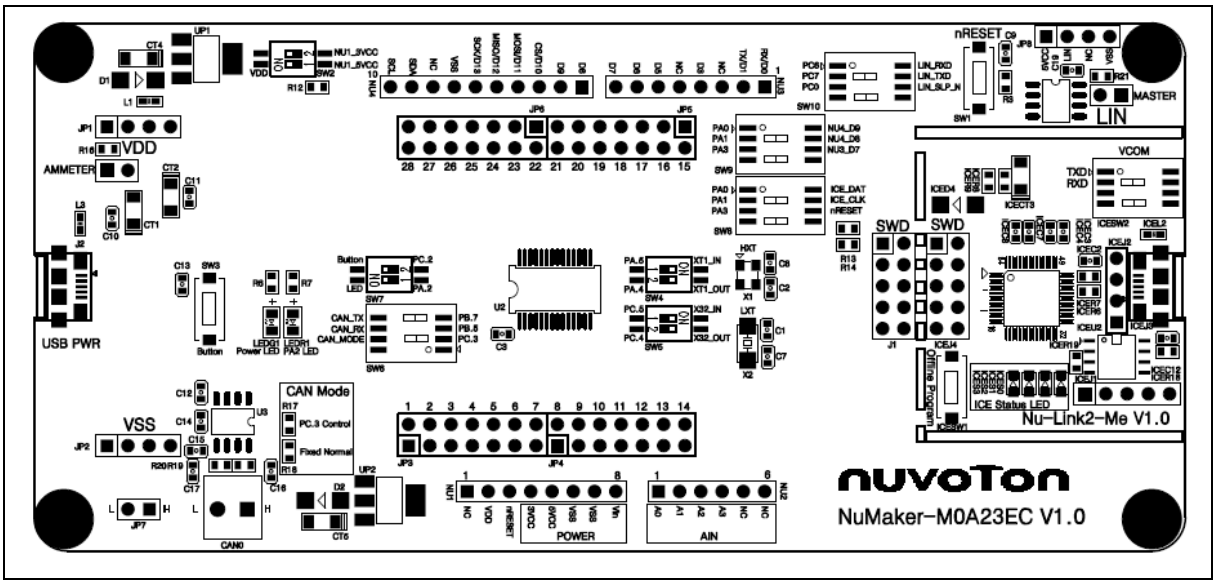


Figure 5-4 Front Placement

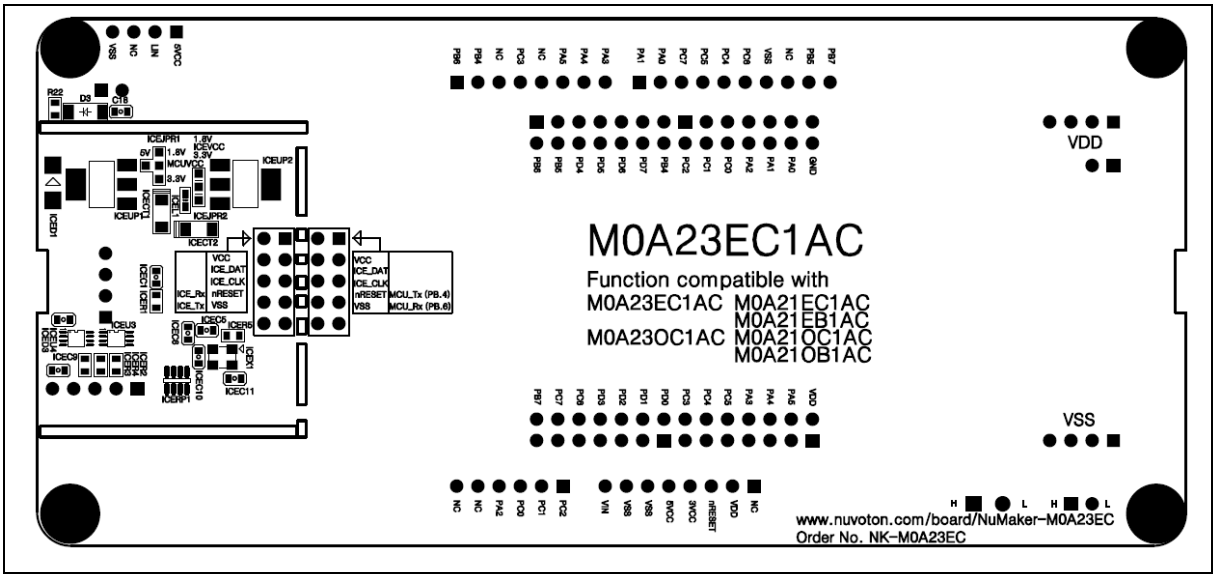


Figure 5-5 Rear Placement

6 REVISION HISTORY

Date	Revision	Description
2021.02.17	1.00	• Initial version

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