NuMicro® Family

Arm® 32-bit Cortex®-M23 Microcontroller

# NuMaker-IoT-M2354U
# NuMaker-IoT-M2354C
# User Manual

***Evaluation Board for NuMicro® M2354 Series***



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

www.nuvoton.com

*Table of Contents*

## *List of Figures*

## List of Tables

# 1 OVERVIEW

The NuMaker-IoT-M2354 is an evaluation board for Nuvoton NuMicro M2354 microcontrollers. The NuMaker-IoT-M2354 consists of two parts, a M2354 target board and an on-board Nu-Link2-Me debugger and programmer. The NuMaker-IoT-M2354 is designed for secure IoT application, prototype development and validation with power consumption monitoring function.

The M2354 target board contains two kinds of wireless modules, Wi-Fi and LoRa. For different frequency band requirement, NuMaker-IoT-M2354U and NuMaker-IoT-M2354C support 915 MHz and 433 MHz frequency band, respectively. The M2354 target board supports CAN and RS485 transceiver for users to develop industrial IoT applications. Furthermore, the M2354 target board is equipped with an environmental sensor and LCD display panel (8 COM/40 SEG) for quick development.

The M2354 target board is based on NuMicro M2354KJFAE. For the development flexibility, the M2354 target board provides the extension connectors of M2354KJFAE, the Arduino UNO compatible headers, mikroBUS™ interface and the capability of adopting multiple power supplies by external power connectors. 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.

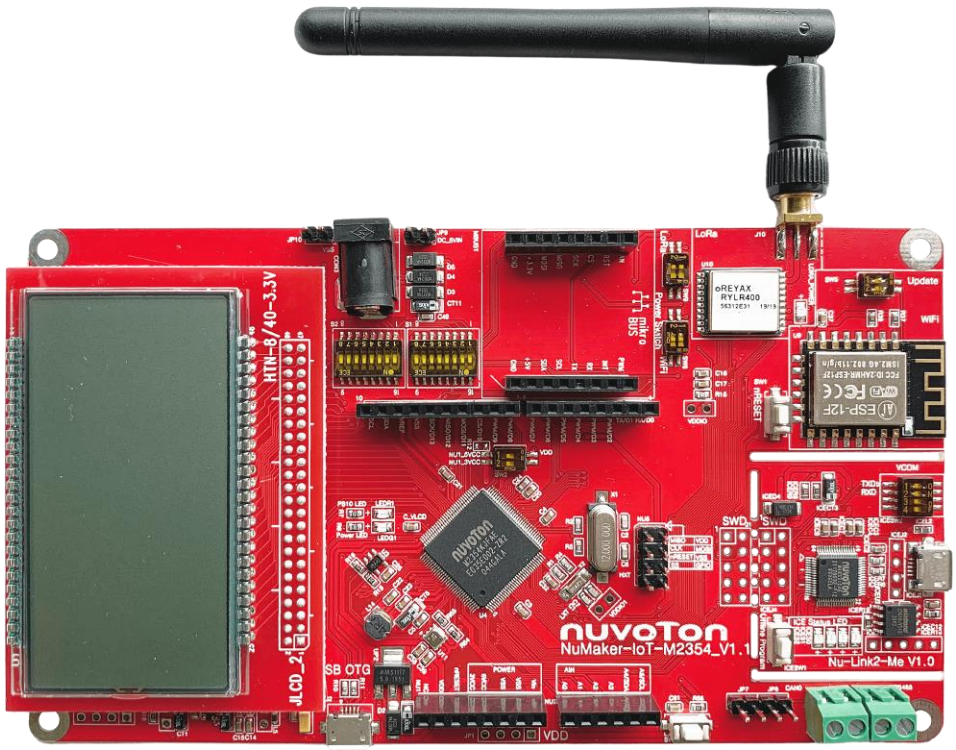


Figure 1-1 NuMaker-IoT-M2354 Evaluation Board

## 2 FEATURES

- NuMicro M2354KJFAE used as main microcontroller with function compatible with:
  - M2354LJFAE
  - M2354SJFAE
- Arduino UNO compatible extension connectors
- mikroBUS compatible connectors
- CAN and RS485 transceiver
- 8COM/40SEG LCD with panel
- Environmental sensor: BME680
- Wi-Fi module
- LoRa module:
  - NuMaker-IoT-M2354U for 915 MHz
  - NuMaker-IoT-M2354C for 433 MHz
- 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 FS connector on M2354 target board
  - ICE USB connector on Nu-Link2-Me
- 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

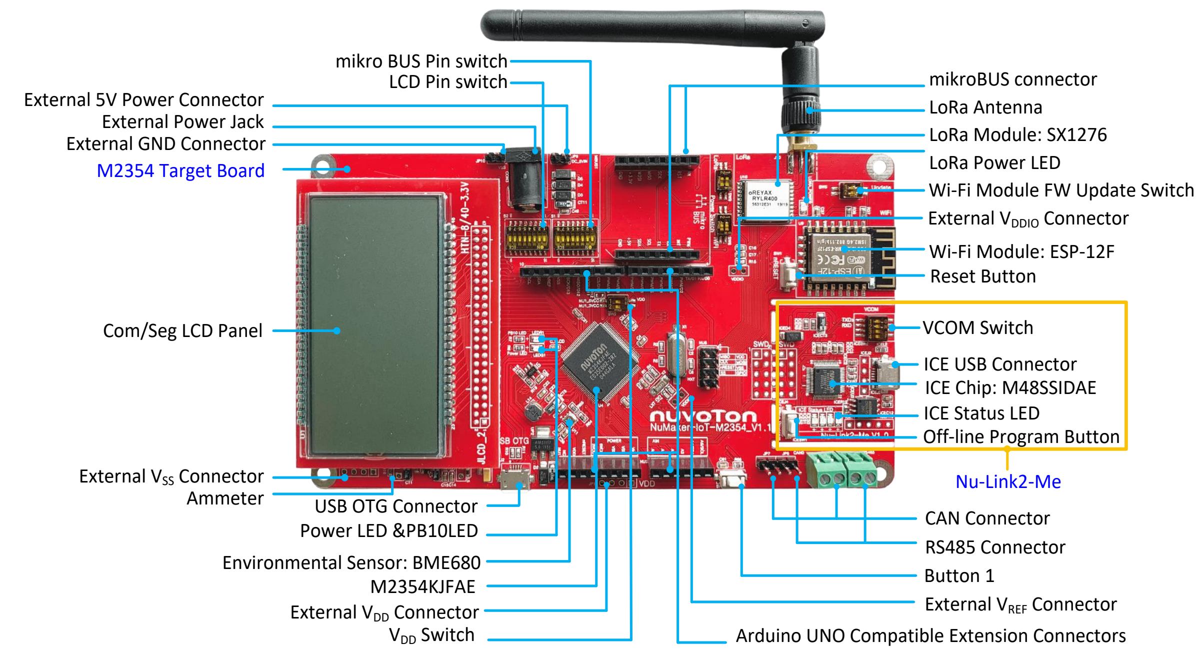



Figure 3-1 Front View of NuMaker-IoT-M2354

Figure 3-1 shows the main components and connectors from the front side of NuMaker-IoT-M2354. The following lists components and connectors from the front view:

- Target Chip: M2354KJFAE (U4)
- USB PWR Connector (J2)
- Arduino UNO Compatible Extension Connectors (NU1, NU2, NU3, NU4)
- External $V_{DD}$ Power Connector (JP1)
- External $V_{SS}$ Power Connector (JP2)
- External $V_{REF}$ Connector (VREF1)
- External $V_{DDIO}$ Connector (VDDIO)
- External Power Jack (CON1)
- $V_{DD}$ Switch (SW2)
- Ammeter Connector (AMMETER)
- Reset Button (SW1) and push Button (SW10)
- Power LED and PD0 LED (LEDG1 and LEDR1)
- Wi-Fi Module (U9)
  - Power Switch (SW8)
  - Firmware Udpate Switch (SW5)
- LoRa Module (U10)
  - Power Switch (SW9)

  - Antenna Connector (J10)
- COM/SEG LCD interface (JLCD_1) and LCD panel (JLCD_2)
  - LCD pin switch (S2)
- Environmental sensor: BME680 (U11)
- mikroBUS connector (MBUS1)
  - mikroBUS pin switch (S1)
- CAN Connector (CAN0 and JP7)
- RS485 Connector (RS485 and JP8)
- 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-IoT-M2354.

The following lists components and connectors from the rear view:

- CAN Transceiver (U13)
- RS485 Transceiver (U14)
- Nu-Link2-Me
  - MCUVCC Power Switch (ICEJPR1)
  - ICEVCC Power Switch (ICEJPR2)

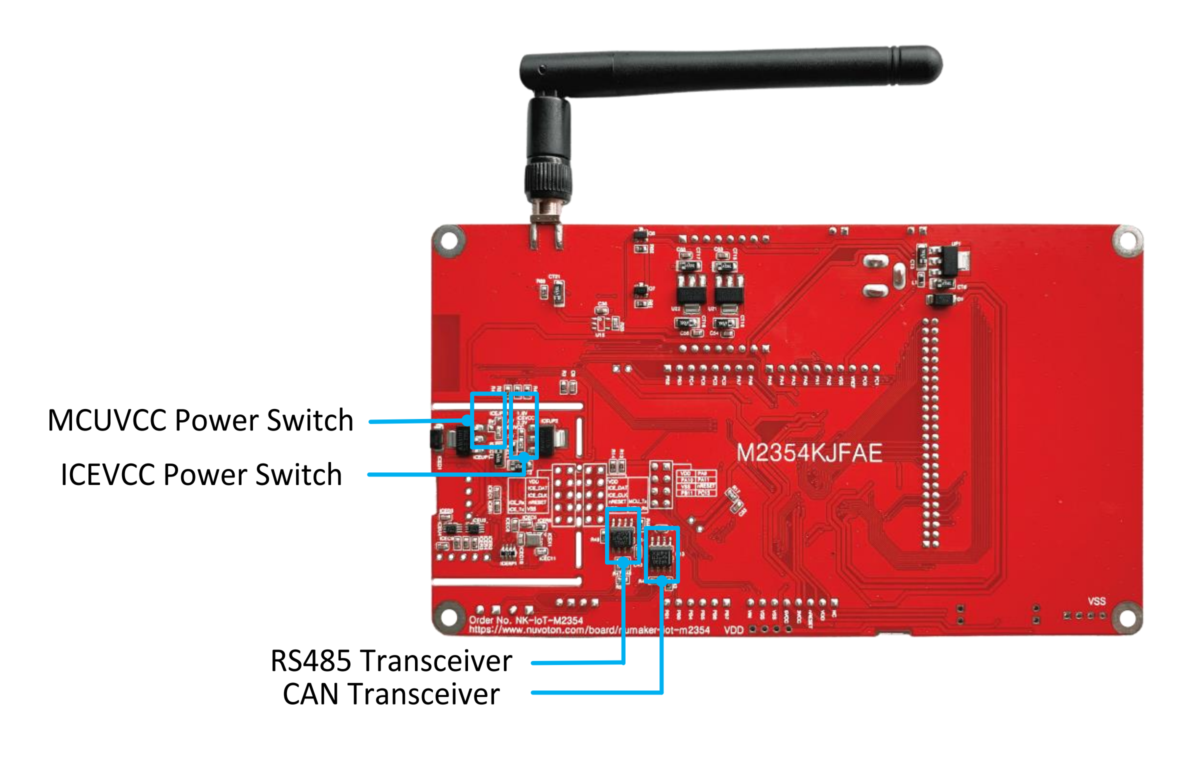



Figure 3-2 Rear View of NuMaker-IoT-M2354

## 3.3 Extension Connectors

Table 3-1 presents the Arduino UNO compatible extension connectors.

| Connector | Description |
|---|---|
| NU1, NU2, NU3 and NU4 | Arduino UNO compatible pins on the NuMaker-IoT-M2354. |

Table 3-1 Extension Connectors

### 3.3.1 Arduino UNO Compatible Extension Connectors

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

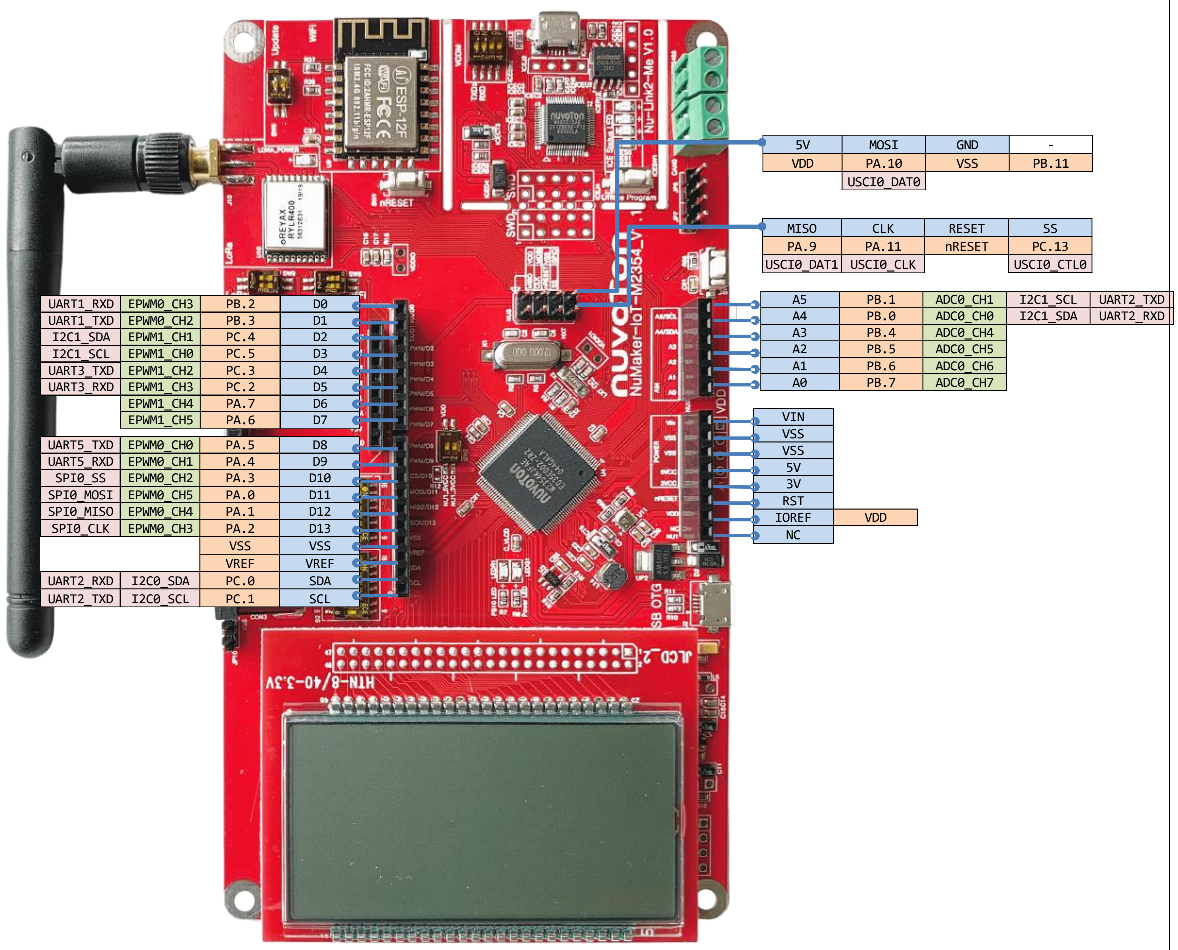



Figure 3-3 Arduino UNO Compatible Extension Connectors

| Header | | NuMaker-IoT-M2354 Compatible to Arduino UNO | NuMaker-IoT-M2354 GPIO Pin of M2354 | Header | | NuMaker-IoTM2354 Compatible to Arduino UNO | NuMaker-IoTM2354 GPIO Pin of M2354 |
|---|---|---|---|---|---|---|---|
| **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 | IOREF | $V_{DD}$ |
| | NU4.6 | D13 | PA.2 | | NU1.1 | NC | - |
| | NU4.7 | AVSS | GND | | | | |
| | NU4.8 | VREF | $V_{REF}$ | | | | |
| | NU4.9 | SDA | PC.0 | | | | |
| | NU4.10 | SCL | PC.1 | | | | |

Table 3-2 Arduino UNO Extension Connectors and M2354KJFAE Mapping GPIO List

## 3.4 mikroBUS Interface

The NuMaker-IoT-M2354 features a MikroElektronika mikroBUS socket which has the smallest number of pins but have maximum expandability. The MikroElektronika mikroBUS consists of communications pins including SPI, UART and $I^2C$, one PWM pin, one interrupt pin, one analog input pin, one reset pin and one chip select pin, and have 3.3V and 5V power pin. Table 3-3 shows mikroBUS Mapping with M2354KJFAE.

For more information about MikroElektronika mikroBUS standard, please visit the MikroElektronika mikroBUS website: https://www.mikroe.com/mikrobus .

| MBUS1 | NuMaker-IoT-M2354 | | MBUS1 | NuMaker-IoT-M2354 | |
|---|---|---|---|---|---|
| | Compatible to mikroBUS | M2354KJFAE | | Compatible to mikroBUS | M2354KJFAE |
| 1 | AN | EADC0_CH10 (PB.10) | 16 | PWM[1] | EPWM0_CH5 (PE.2) |
| 2 | RST | PD.4 | 15 | INT | PD.5 |
| 3 | CS[1] | QSPI0_SS (PH.9) | 14 | RX[1] | UART5_RXD (PE.6) |
| 4 | SCLK[1] | QSPI0_CLK (PH.8) | 13 | TX[1] | UART5_TXD (PE.7) |
| 5 | MISO[1] | QSPI0_MISO0 (PE.1) | 12 | SCL | I2C1_SCL (PB.1) |
| 6 | MOSI[1] | QSPI0_MOSI0 (PE.0) | 11 | SDA | I2C1_SDA (PB.0) |
| 7 | 3VCC | - | 10 | 5VCC | - |
| 8 | GND | - | 9 | GND | - |
| **Note**:<br>Switch S1.1 to S1.7 to ON when using mikroBUS functions | | | | | |

Table 3-3 mikroBUS Mapping with M2354KJFAE

## 3.5 Pin Assignment for On-board Modules, Sensors and Connectors

The NuMaker-IoT-M2354 provides several on-board modules, sensors and connectors. Table 3-4 shows the mapping GPIO list.

| On-board Module/Sensor/Connector | | NuMaker-IoT-M2354 | |
|---|---|---|---|
| | | Function of GPIO Pin | GPIO Pin of M2354KJFAE |
| **Wi-Fi** | UART_TX | UART4_RXD | PC.6 |
| | UART_RX | UART4_TXD | PC.7 |
| | UART_RTS | UART4_nCTS | PC.8 |
| | UART_CTS | UART4_nRTS | PE.13 |
| | RST | GPIO | PE.12 |
| **LoRa** | MISO | SPI3_MISO | PC.12 |
| | MOSI | SPI3_MOSI | PC.11 |
| | SCK | SPI3_CLK | PC.10 |

| On-board Module/Sensor/Connector | | NuMaker-IoT-M2354 | |
|---|---|---|---|
| | | Function of GPIO Pin | GPIO Pin of M2354KJFAE |
| | NSS | SPI3_SS | PC.9 |
| | NRST | GPIO | PF.6 |
| | DIO0 | GPIO | PF.7 |
| | DIO1 | GPIO | PF.8 |
| | DIO2 | GPIO | PF.9 |
| | DIO3 | GPIO | PF.10 |
| | DIO4 | GPIO | PF.11 |
| | DIO5 | GPIO | PD.12 |
| | LoRa_TCXO_EN | GPIO | PA.8 |
| **Environmental Sensor** | SDI | I2C2_SDA | PB.12 |
| | SCL | I2C2_SCL | PB.13 |
| **CAN Transceiver** | CAN_D | CAN0_TXD | PD.11 |
| | CAN_R | CAN0_RXD | PD.10 |
| **RS485 Transceiver** | RS485_RO | USCI0_DAT0 | PE.10 |
| | RS485_DI | USCI0_DAT1 | PE.11 |
| | RS485_DE | USCI0_CTL1 | PE.8 |

Table 3-4 On-board Modules, Sensors, Connectors and M2354KJFAE GPIO Function List

## 3.6 Power Supply Configuration

The NuMaker-IoT-M2354 is able to adopt multiple power supply. External power source includes NU1 Vin (7 V to 12 V), $V_{DD}$ (depending on target chip operating voltage), and PC through USB connector. By using switches and voltage regulator, multiple power domains can be created on the NuMaker-IoT-M2354.

### 3.6.1 VIN Power Source

Table 3-5 presents the Vin power source.

| Connector | Net Name in Schematic | Comment |
|---|---|---|
| NU1 pin8 | NU1_VIN | Board external power source, with voltage range from 7 V to 12 V. The voltage regulator UP2 converts the NU1 pin8 input voltage to 5V and supplies it to NuMaker-IoT-M2354. |

Table 3-5 Vin Power Source

### 3.6.2 5V Power Sources

Table 3-6 presents the 5 V power sources.

| Connector | Net Name in Schematic | Comment |
|---|---|---|
| ICEJ3 | USB_HS_VBUS | ICE USB connector supplies 5 V power from PC to M2354 target board and Nu-Link2-Me. |
| J2 | USB_VBUS | USB connector on NuMaker-IoT-M2354 supplies 5 V power from PC to M2354 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 the target chip or Arduino adapter board.<br>**Note:** The M2354 operating voltage range is from 1.7 V to 3.6 V. Do not switch SW2.1 (NU1 5VCC) to ON. |
| CON3 | DC5V_IN | External 5V from power adapter to on-board modules. |

Table 3-6 5V Power Sources

### 3.6.3 3.3 V Power Sources

Table 3-8 presents the 3.3 V power sources.

| Voltage Regulator | 5V Source | Comment |
|---|---|---|
| ICEUP1 | USB_HS_VBUS | ICEUP1 converts USB_HS_VBUS to 3.3 V and supplies 3.3V to M2354 target board or ICE chip. |
| UP1 | USB_VBUS | UP1 converts USB_VBUS to 3.3 V and supplies 3.3 V to M2354 target board.<br>**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 M2354 target board.<br>**Note:** SW2.2(NU1 3VCC) should be switched to ON. |

Table 3-7 3.3 V Power Sources

### 3.6.4 1.8V Power Sources

Table 3-8 presents the 1.8 V power source.

| Voltage Regular | 5V Source | Comment |
|---|---|---|
| ICEUP2 | USB_HS_VBUS | ICEUP2 converts USB_HS_VBUS to 1.8V and supplies 1.8V to M2354 target board or ICE chip. |

Table 3-8 1.8V Power Sources

### 3.6.5 Power Connectors

Table 3-9 presents the power connectors.

| Connector | Comment |
|---|---|
| JP1 | $V_{DD}$ connector on the NuMaker-IoT-M2354.<br>**Note:** M2354 operating voltage range is from 1.7 V to 3.6 V. |
| JP2, JP10 | $V_{SS}$ connector on the NuMaker-IoT-M2354. |
| JP9 | 5 V connector on the NuMaker-IoT-M2354 for on-board modules. |

Table 3-9 Power Connectors

### 3.6.6 USB Connectors

Table 3-10 presents the USB connectors.

| Connector | Comment |
|---|---|
| ICEJ3 | ICE USB connector on Nu-Link2-Me for power supply, debugging and programming from PC. |
| J2 | USB FS connector on NuMaker-IoT-M2354 for power supply. |

Table 3-10 USB Connectors

### 3.6.7 Power Switches

Table 3-11 presents the power switches.

| Switch | Comment |
|---|---|
| ICEJPR1 | Configures the target chip operating voltage at 1.8 V / 3.3 V / 5 V.<br>**Note:** M2354 operating voltage range is from 1.7 V to 3.6 V. Do not switch ICEJPR1 (MCUVCC) to 5 V. |
| ICEJPR2 | Configures the ICE chip operating voltage at 1.8 V / 3.3 V. |
| SW2 | Configures the target chip power source from ICE or NU1_3VCC. |
| SW8 | Turn on/off the power to Wi-Fi module. All pins should be the same side. |
| SW9 | Turn on/off the power to LoRa module. All pins should be the same side. |

Table 3-11 Power Switches

### 3.6.8 CAN Connectors

Table 3-12 presents the CAN connectors.

| Connector | Comment |
|---|---|
| CAN0 and JP7 | CAN connector on NuMaker-IoT-M2354 for CAN function. |

Table 3-12 CAN Connectors

### 3.6.9 RS485 Connectors

Table 3-13 presents the RS485 connectors.

| Connector | Comment |
|---|---|
| RS485 and JP8 | RS485 connector on NuMaker-IoT-M2354 for RS485 function. |

Table 3-13 RS485 Connectors

### 3.6.10 Power Supply Models

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

The external power supply source on Nu-Link2-Me is shown in Figure 3-4.

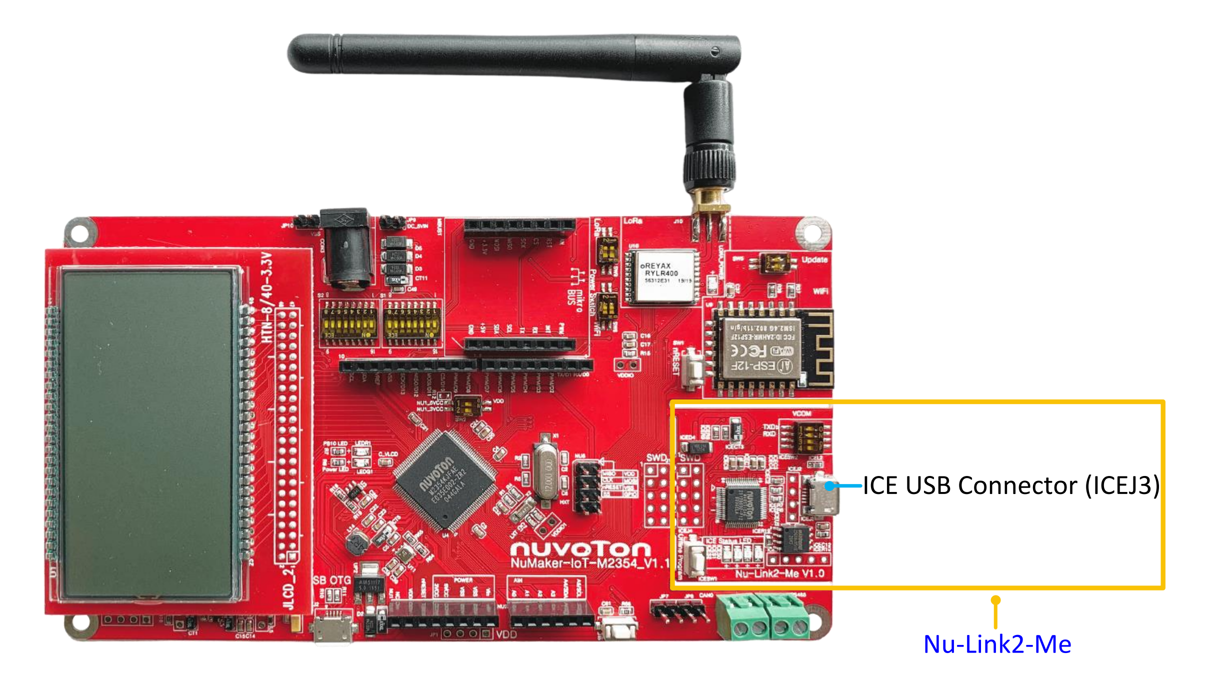



Figure 3-4 External Power Supply Sources on Nu-Link2-Me

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. Connect the external power supply to ICEJ3.

Table 3-14 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 | SW4 Selection | J2 | Vin | JP13 |
|---|---|---|---|---|---|---|---|---|---|
| 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 | 5V | 3.3 V (default) | 3.3 V | Off | - | - | 5 V output |
| | -: Unused.<br>**Note**:<br>1. 0 Ω should be soldered between ICEJPR1's MCUVCC and 1.8 V / 3.3 V / 5 V.<br>2. 0 Ω should be soldered between ICEJPR2's ICEVCC and 1.8 V / 3.3 V. | | | | | | | | |

Table 3-14 Supply External Power through Nu-Link2-Me

### *3.6.10.2 External Power Supply through M2354 target board to Target Chip*

The external power supply sources on M2354 target board are shown in Figure 3-5.

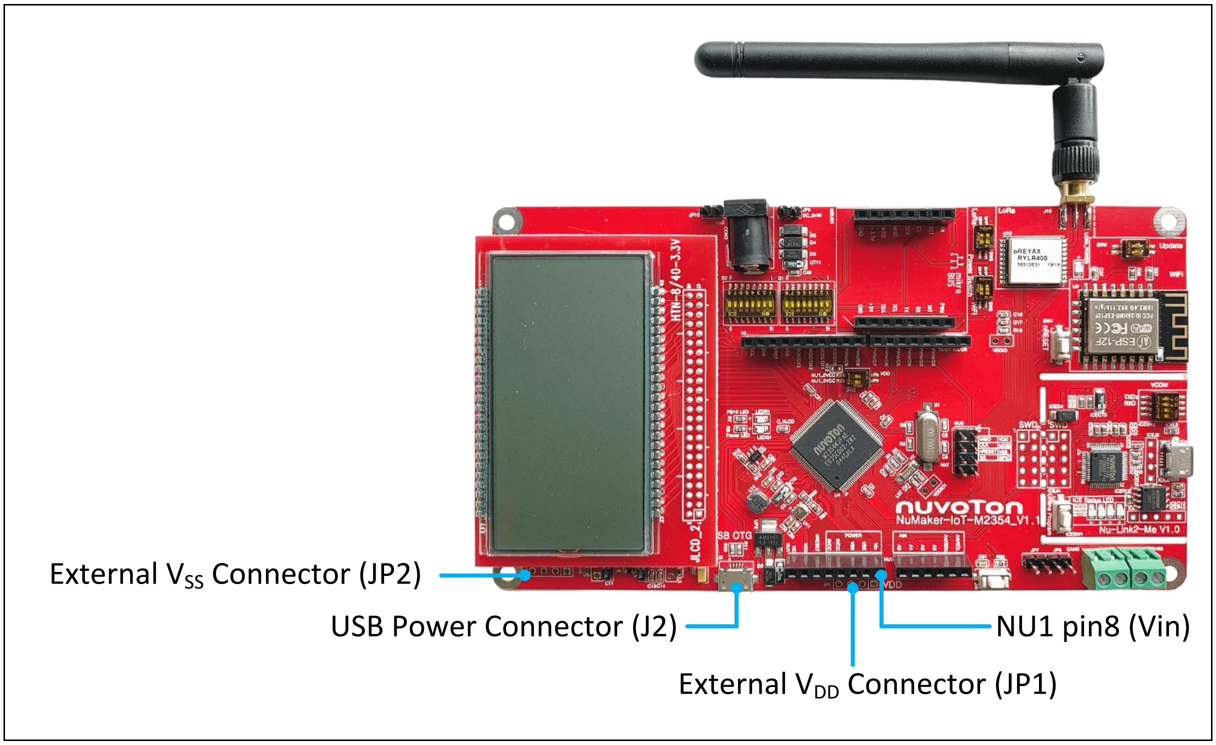



Figure 3-5 External Power Supply Sources on M2354 target board

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 separated from NuMaker-IoT-M2354, please follow the steps below:

1. Switch the SW2 depending on the target chip operating voltage.
2. Separate the Nu-Link2-Me from NuMaker-IoT-M2354.
3. Connect the external power supply to Vin or J2.

To use JP1 as external power supply source with Nu-Link2-Me separated from NuMaker-IoT-M2354, please follow the steps below:

1. Switch the SW2 to OFF.
2. Separate the Nu-Link2-Me from NuMaker-IoT-M2354.
3. Connect the external power supply to JP1.

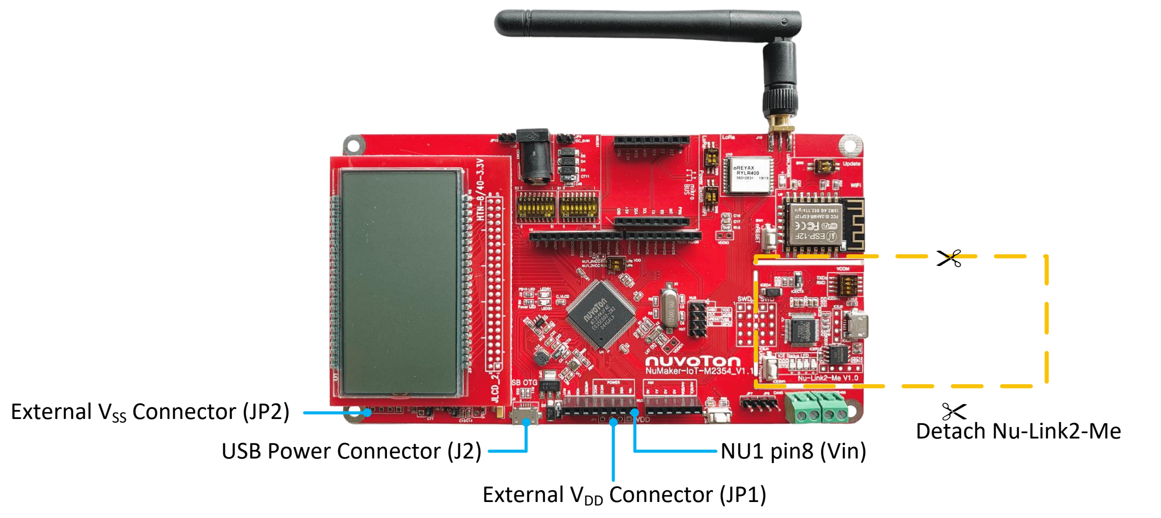



Figure 3-6 Separate the Nu-Link2-Me from NuMaker-IoT-M2354

Table 3-15 presents all power models when supplying external power through the M2354 target board.

The M2354 target board external power sources are highlighted in yellow.

| Model | Target Chip Voltage | Vin [1] | J2 | ICEJ3 | SW2 Selection | JP1 | ICEJPR1 (MCUVCC) Selection [2] | ICEJPR2 (ICEVCC) Selection [3] | ICE Chip Voltage [4] |
|---|---|---|---|---|---|---|---|---|---|
| 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 | 1.8 V ~ 3.6 V | - [5] | - [5] | 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 |
| 7 | 1.8 V ~ 3.6 V | - [5] | - [5] | Nu-Link2-Me removed | OFF | DC Input 1.8 V ~ 3.6 V | - | - | - |

**-**: Unused.

**Note**:

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

Table 3-15 Supply External Power for M2354 target board

## 3.7 On-board Module Power Supply Models

The external power supply sources on NuMaker-IoT-M2354 to on-board modules are shown in Figure 3-7.

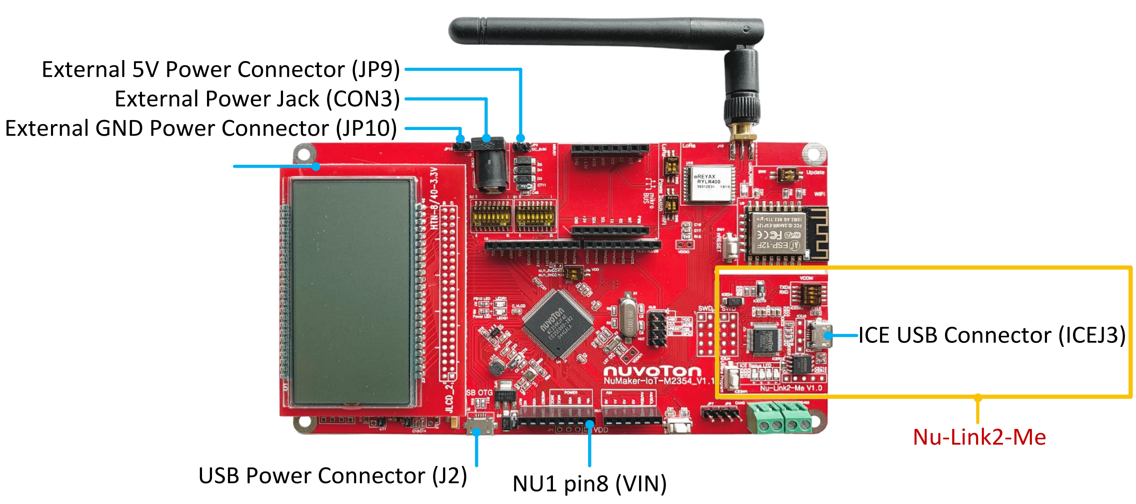



Figure 3-7 External Power Supply Sources on NuMaker-IoT-M2354 for On-board Modules

Table 3-16 presents all power models when supplying external power through NuMaker-IoT-M2354 The external power sources are highlighted in yellow.

| Mode I | Wi-Fi Module Voltage [1] | LoRa Module Voltage [2] | ICEJ3 | VIN [3] | J2 | CON3[4] | JP9 [4] |
|---|---|---|---|---|---|---|---|
| 1 | 3.3 V | 3.3 V | Connect to PC | Ignore | Ignore | Ignore | Ignore |
| 2 | 3.3 V | 3.3 V | Ignore | 7 V ~ 12 V Input | Ignore | Ignore | Ignore |
| 3 | 3.3 V | 3.3 V | Ignore | Ignore | Connect to PC | Ignore | Ignore |
| 4 | 3.3 V | 3.3 V | Ignore | Ignore | Ignore | DC Input 5 V | Ignore |
| 5 | 3.3 V | 3.3 V | Ignore | Ignore | Ignore | Ignore | DC Input 5 V |

X: Unused.

**Note**:

1. All of the input voltage will be converted by voltage regulator U21 to 3.3 V.
2. All of the input voltage will be converted by voltage regulator U22 to 3.3 V.
3. The VIN input voltage will be converted by voltage regulator UP2 to 5 V.
4. JP9 external power input only provides voltage to on-board modules.

Table 3-16 Supply External Power for On-board Modules

## 3.8 External Reference Voltage Connector

Table 3-17 presents the external reference voltage connector.

| Connector | Comment |
|---|---|
| VREF1 | VREF1 is used to easily connect to the external reference voltage pin of the target chip. Remove the L11 ferrite bead before using it. |

Table 3-17 External Reference Voltage Connector

## 3.9 Ammeter Connector

Table 3-18 presents the ammeter connector.

| Connector | Comment |
|---|---|
| AMMETER | AMMETER is used to easily measure the target chip power consumption. Remove the R16 resistor before using it. |

Table 3-18 Ammeter Connector

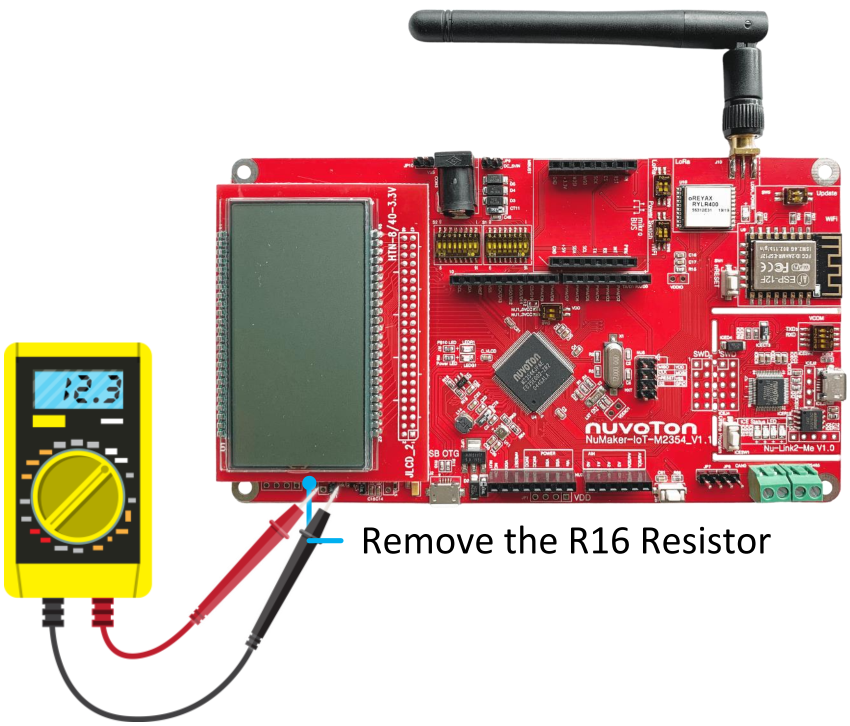



Figure 3-8 Wiring between Ammeter Connector and Ammeter

## 3.10 Push-Buttons

Table 3-19 presents the push-buttons.

| Component | Comment |
|---|---|
| ICESW1 | Off-line program button to start off-line programming the target chip. |
| SW1 | Reset button to reset the target chip. |
| SW10 | Customize button is connected to the target chip PE.10. |

Table 3-19 Push-Buttons

## 3.11 LEDs

Table 3-20 presents the LEDs.

| Component | Comment |
|---|---|
| Power LED | The power LED indicates that the NuMaker-IoT-M2354 is powered. |
| PD0 LED | The LED is connected to the target chip PD.0. |
| LoRa_Power | The power LED indicates that the LoRa module is powered. |
| ICES0, ICES1, ICES2 and ICES3 | Nu-Link2-Me status LED. |

Table 3-20 LEDs

### 3.12 Wi-Fi Module Update Switch

Table 3-21 presents the Wi-Fi module update switch.

| Switch | Comment |
|---|---|
| SW5 | Turn on the SW5_2 to enable Wi-Fi update. All pins should be the same side. |

Table 3-21 Wi-Fi Module Update Switch

### 3.13 COM/SEG LCD interface and HTN-LCD Panel

The NuMaker-IoT-M2354 equip with a COM/SEG LCD interface which can connect to LCD panel.

**JLCD_1**: 8 COM / 40 SEG LCD connective interface.

**JLCD_2**: LCD Panel (HTN-3.3V)

| Function of GPIO Pin | GPIO Pin of M2354KJFAE | Function of GPIO Pin | GPIO Pin of M2354KJFAE |
|---|---|---|---|
| LCD_COM0 | PC.0 | LCD_SEG16 | PG.14 |
| LCD_COM1 | PC.1 | LCD_SEG17 | PG.13 |
| LCD_COM2 | PC.2 | LCD_SEG18 | PG.12 |
| LCD_COM3 | PC.3 | LCD_SEG19 | PG.11 |
| LCD_COM4/LCD_SEG43 | PC.4 | LCD_SEG20 | PG.10 |
| LCD_COM5//LCD_SEG42 | PC.5 | LCD_SEG21 | PG.9 |
| LCD_COM6//LCD_SEG41 | PD.8 | LCD_SEG22 | PE.15 |
| LCD_COM7//LCD_SEG40 | PD.9 | LCD_SEG23 | PE.14 |
| LCD_SEG0 | PH.11 | LCD_SEG24 | PA.0 |
| LCD_SEG1 | PH.12 | LCD_SEG25 | PA.1 |
| LCD_SEG2 | PH.10 | LCD_SEG26 | PA.2 |
| LCD_SEG3 | PH.9 | LCD_SEG27 | PA.3 |
| LCD_SEG4 | PH.8 | LCD_SEG28 | PA.4 |
| LCD_SEG5 | PE.0 | LCD_SEG29 | PA.5 |
| LCD_SEG6 | PE.1 | LCD_SEG30 | PE.10 |
| LCD_SEG7 | PE.2 | LCD_SEG31 | PE.9 |
| LCD_SEG8 | PE.3 | LCD_SEG32 | PE.8 |
| LCD_SEG9 | PE.4 | LCD_SEG33 | PH.7 |
| LCD_SEG10 | PE.5 | LCD_SEG34 | PH.6 |
| LCD_SEG11 | PE.6 | LCD_SEG35 | PH.5 |
| LCD_SEG12 | PE.7 | LCD_SEG36 | PH.4 |
| LCD_SEG13 | PD.6 | LCD_SEG37 | PG.4 |
| LCD_SEG14 | PD.7 | LCD_SEG38 | PG.3 |
| LCD_SEG15 | PG.15 | LCD_SEG39 | PG.2 |

| |
|---|
| **Note**: Switch S2.1 to S2.7 to ON when using LCD function. |

Table 3-22 COM/SEG LCD function of M2354KJFAE

## 3.14 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 off-line 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 can be shown on the built-in LEDs. Lastly, the Nu-Link2-Me can be detached from the evaluation board and becoming a stand-alone mass production programmer. For more information about Nu-Link2-Me, please refer to *Nu-Link2-Pro Debugger and Programmer User Manual*.

### 3.14.1 VCOM Switches

Table 3-23 presents how to set the VCOM function by ICESW2.

| ICESW2 | | |
|---|---|---|
| **Pin** | **Function** | **Description** |
| 1 | TXD | **On**: Connect target chip PB.9 (UART0_TXD) to Nu-Link2-Me.<br>**Off**: Disconnect target chip PB.9 (UART0_TXD) to Nu-Link2-Me. |
| 2 | RXD | **On**: Connect target chip PB.8 (UART0_RXD) to Nu-Link2-Me.<br>**Off**: Disconnect target chip PB.8 (UART0_RXD) to Nu-Link2-Me. |
| **Note:** Pin 3 and 4 is unused. | | |

Table 3-23 VCOM Function of Nu-Link2-Me

### 3.14.2 Status LEDs

Table 3-24 presents the status LEDs patterns for different operation on Nu-Link2-Me.

| **Operation Status** | **Status LED** | | | |
|---|---|---|---|---|
| | **ICES0** | **ICES1** | **ICES2** | **ICES3** |
| Power on | Flash x 3 | Flash x 3 | Flash x 3 | Flash x 3 |
| Connected to IDE/NuTool | 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 Off-line Programming | - | On | - | Flash |
| Off-line Programming Completed | On | - | - | - |
| Off-line Programming Completed (Auto mode) | On | On | - | - |
| Off-line Programming Failed | On | Flash | - | - |

Table 3-24 Status LEDs patterns of Nu-Link2-Me

# 4 QUICK START

## 4.1 Toolchains Support

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)(Windows)
- NuEclipse (GCC)(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.

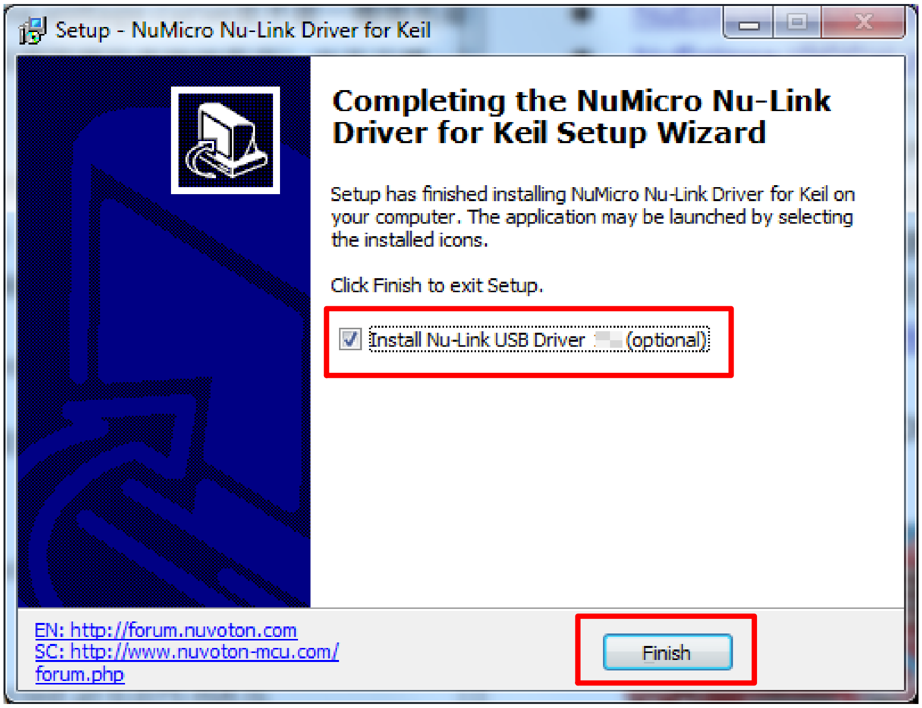



Figure 4-1 Nu-Link USB Driver Installation Setup

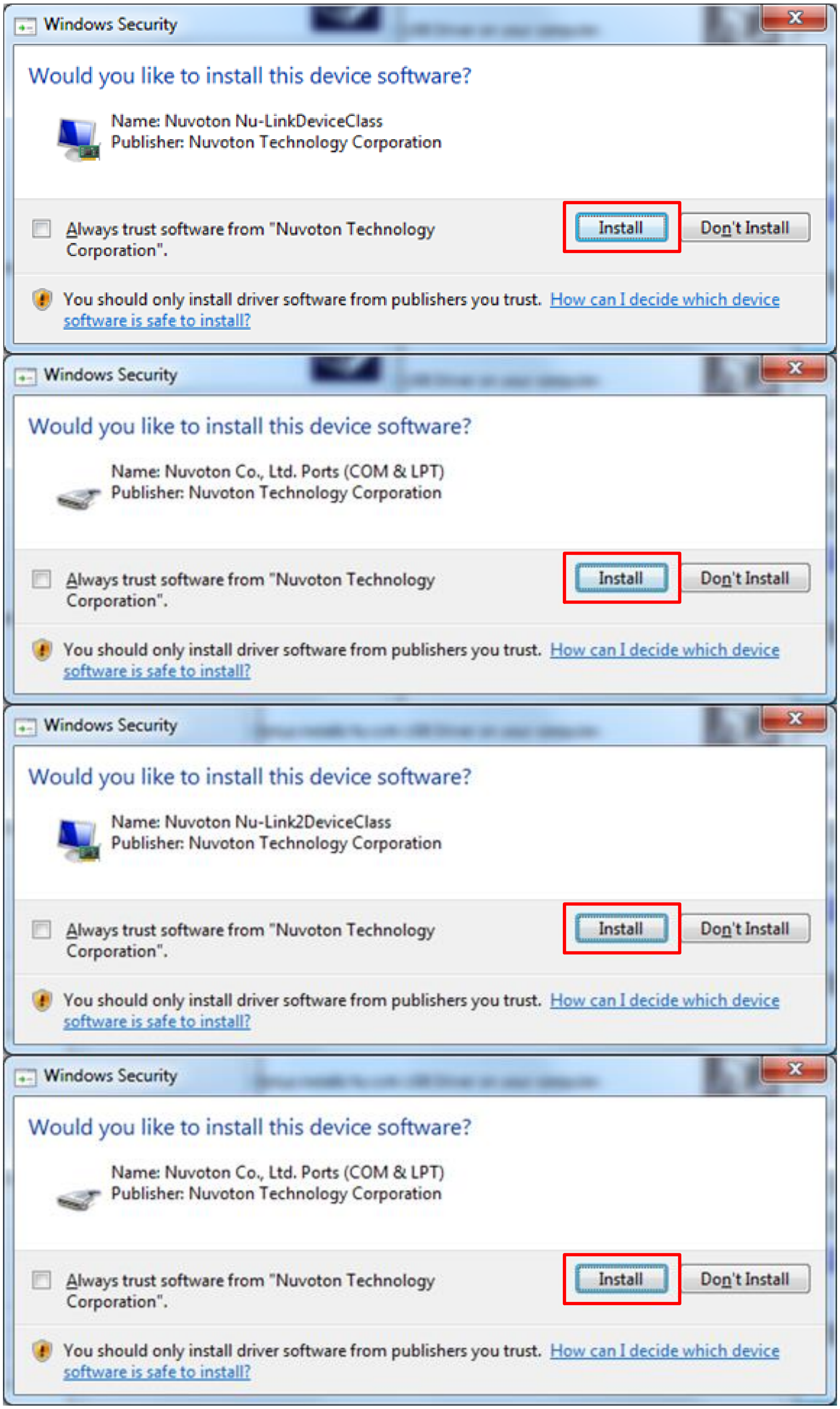



Figure 4-2 Nu-Link USB Driver Installation

## 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.

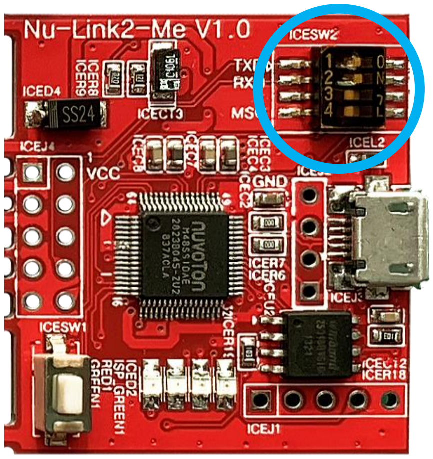



Figure 4-3 Open VCOM Function

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

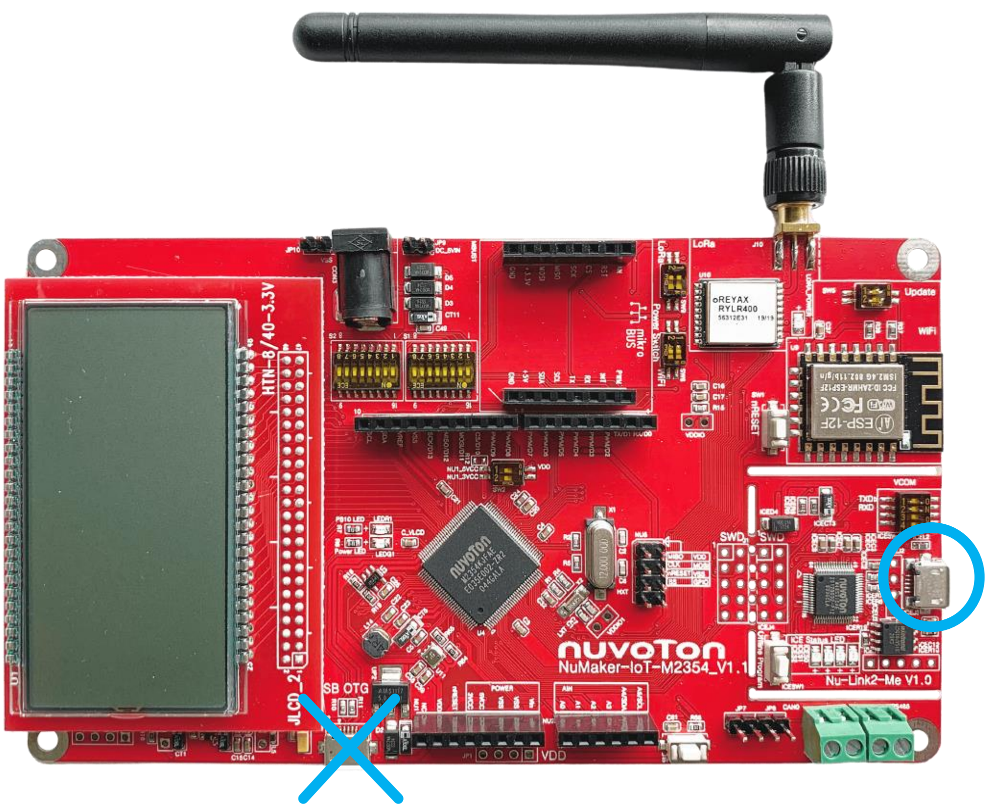


Figure 4-4 ICE USB Connector

3. Find the “Nu-Link2 Virtual Com Port” on the Device Manger as Figure 4-5.

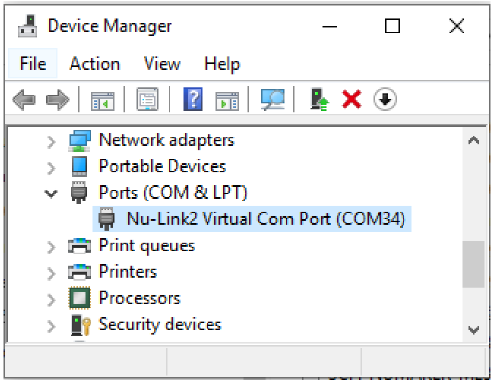



Figure 4-5 Device Manger

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.

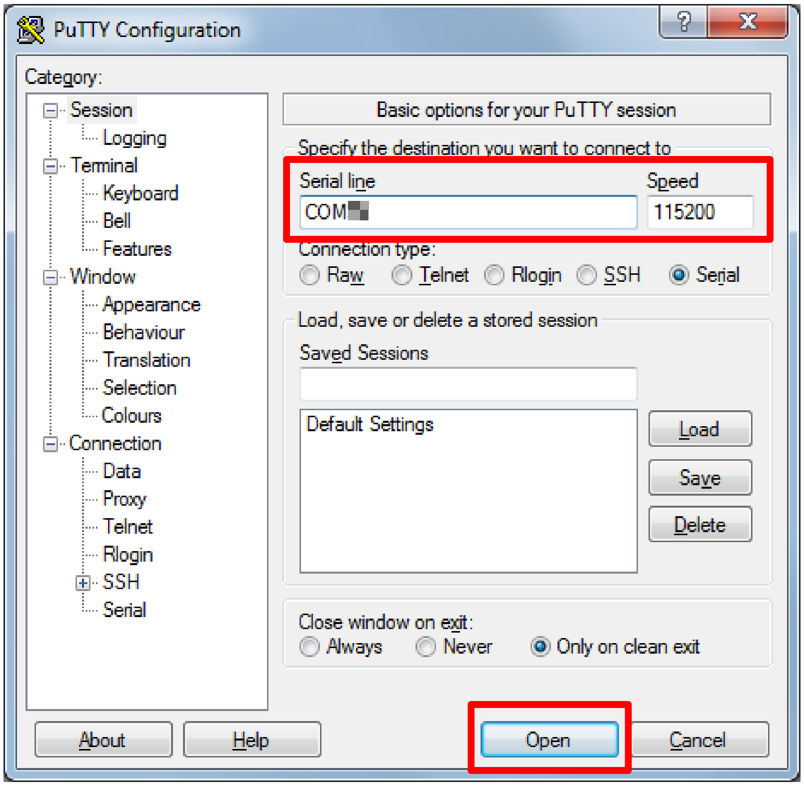



Figure 4-6 PuTTY Session Setting

## 4.5 Finding the Example Project

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

- M2354_BSP
  - SampleCode
    - NuMaker
      - Blinky
        - Keil
        - IAR
        - GCC

Figure 4-7 Blinky Project Folder Path

## 4.6 Executing 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 “Blinky.uvprojx” to open the project.
2. Make sure the debugger is “Nuvoton Nu-Link Debugger” as shown in Figure 4-8 and Figure 4-9.

   **Note:** If the dropdown menu in Figure 4-8 does not contain “Nuvoton Nu-Link Debugger” item, please rework section 4.2.

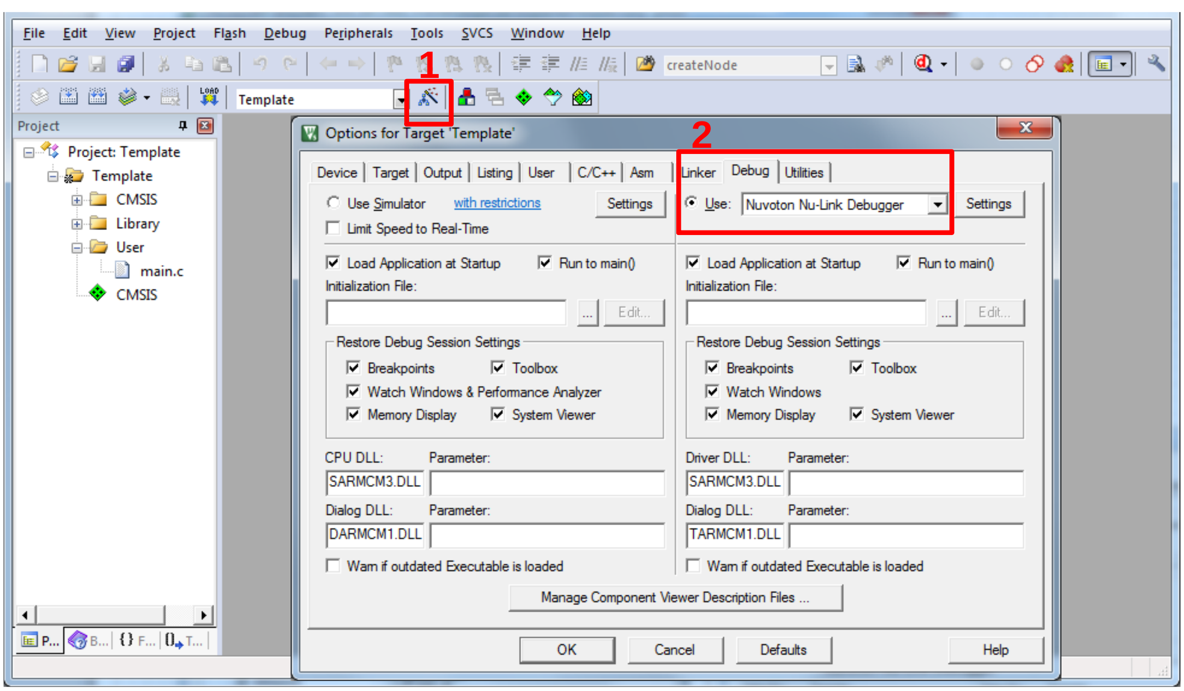



Figure 4-8 Debugger Setting in Options Window

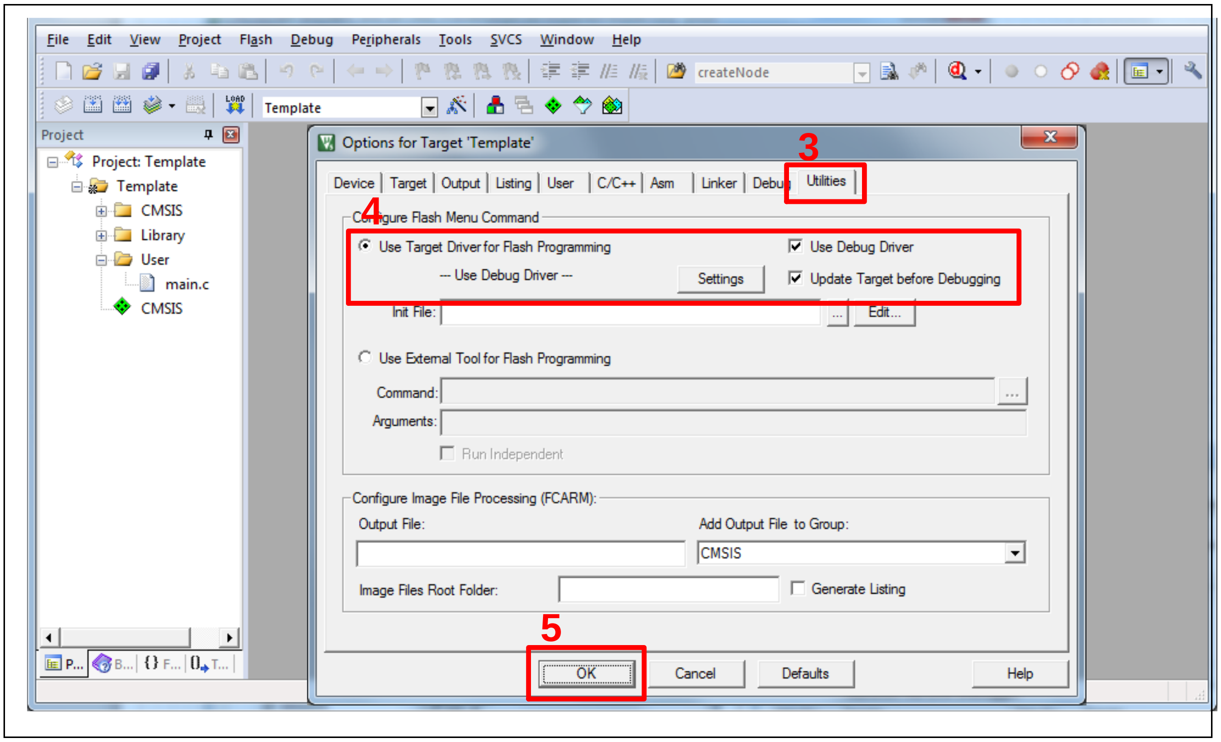



Figure 4-9 Programming Setting in Options Window

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

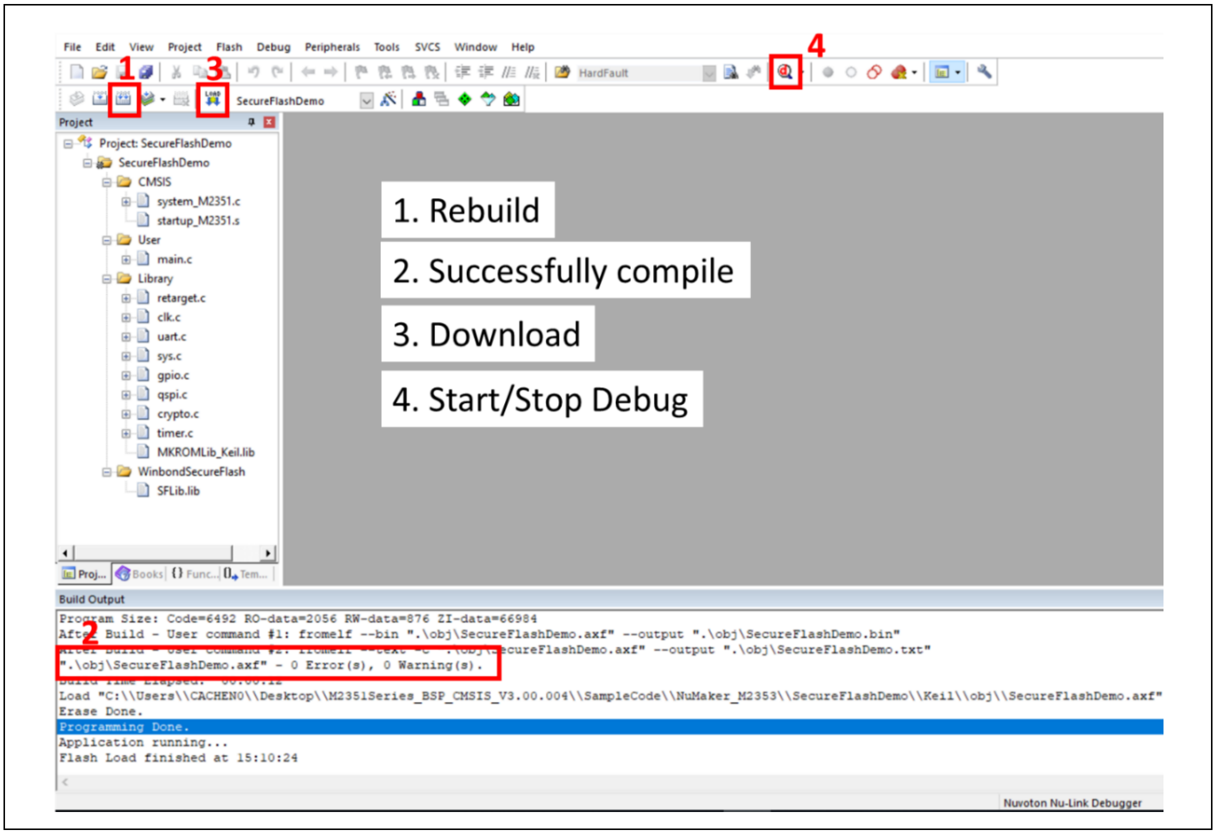



Figure 4-10 Compile and Download the Project

4. Figure 4-11 shows the debug mode under Keil MDK. Click “**Run**” and the debug message will be printed out as shown in Figure 4-12. User can debug the project under debug mode by checking source code, assembly language, peripherals’ registers, and setting breakpoint, step run, value monitor, etc.

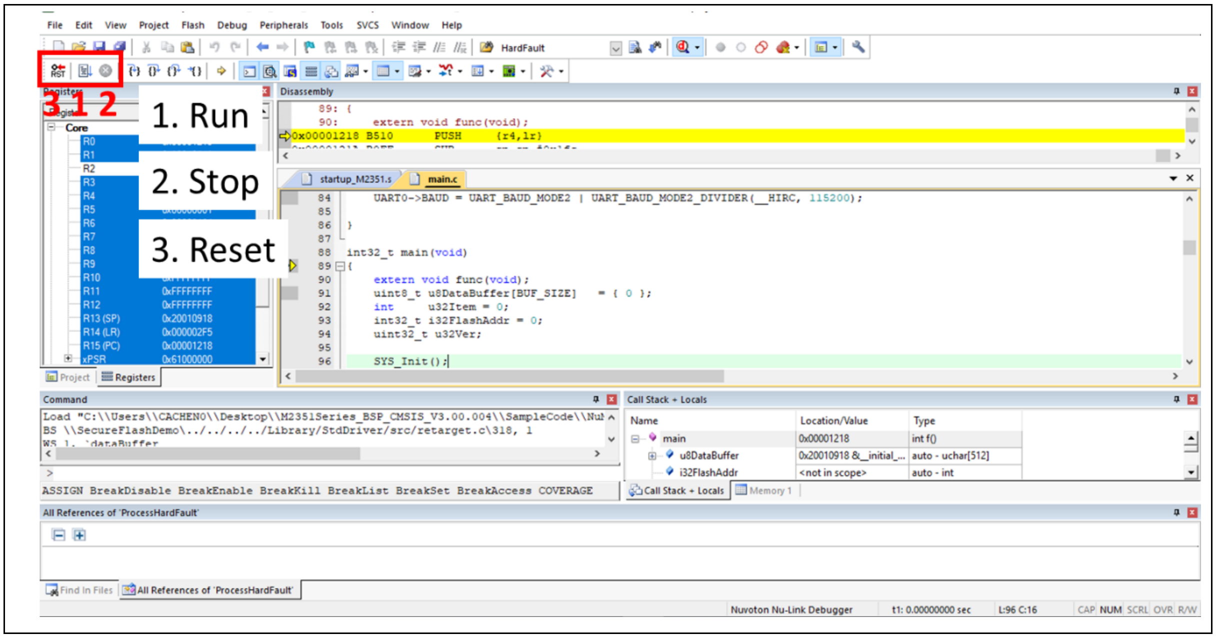



Figure 4-11 Keil MDK Debug Mode

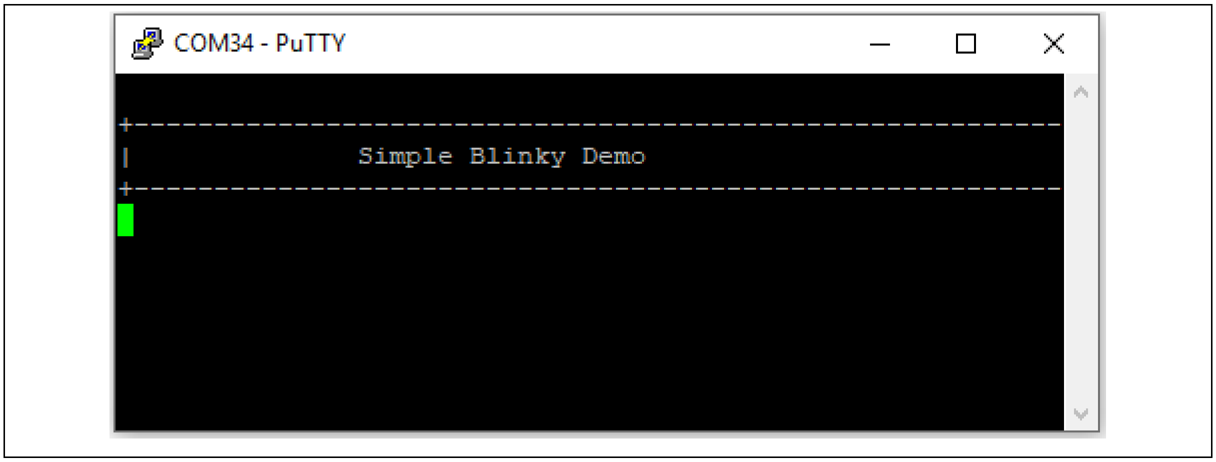



Figure 4-12 Debug Message on Serial Port Terminal Windows

### 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 “Blinky.eww” to open the project.
2. Make sure the toolbar contain “Nu-Link” item as shown in Figure 4-13.

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

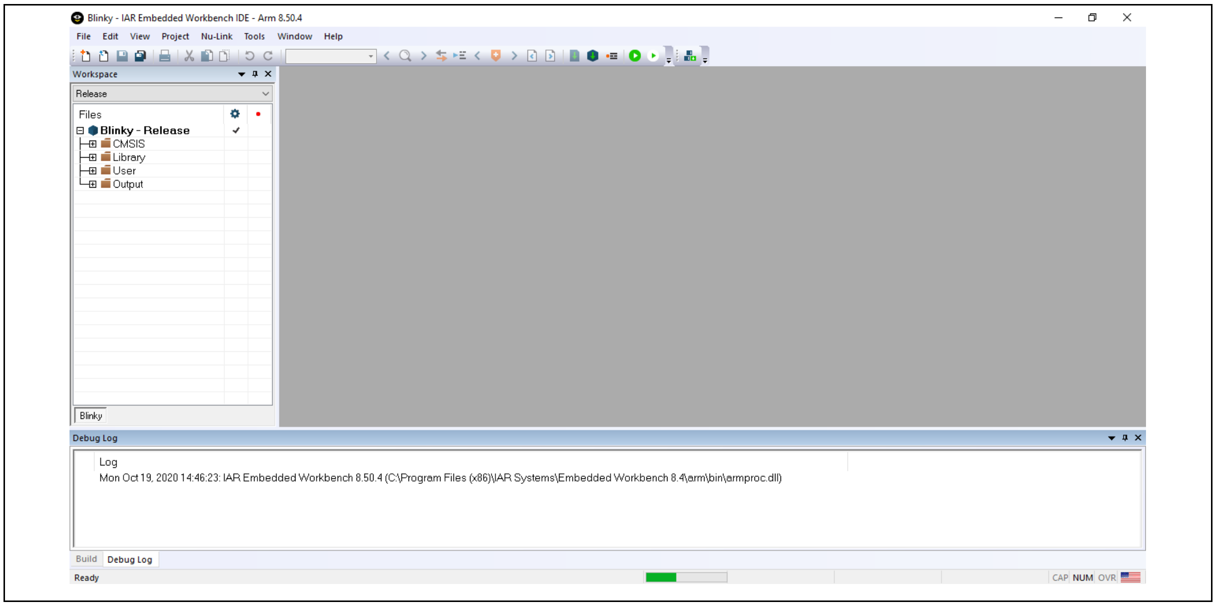



Figure 4-13 IAR EWARM Window

3. Make target file as presented in Figure 4-14. After successfully compiling the project, download code to the Flash memory and enter debug mode.

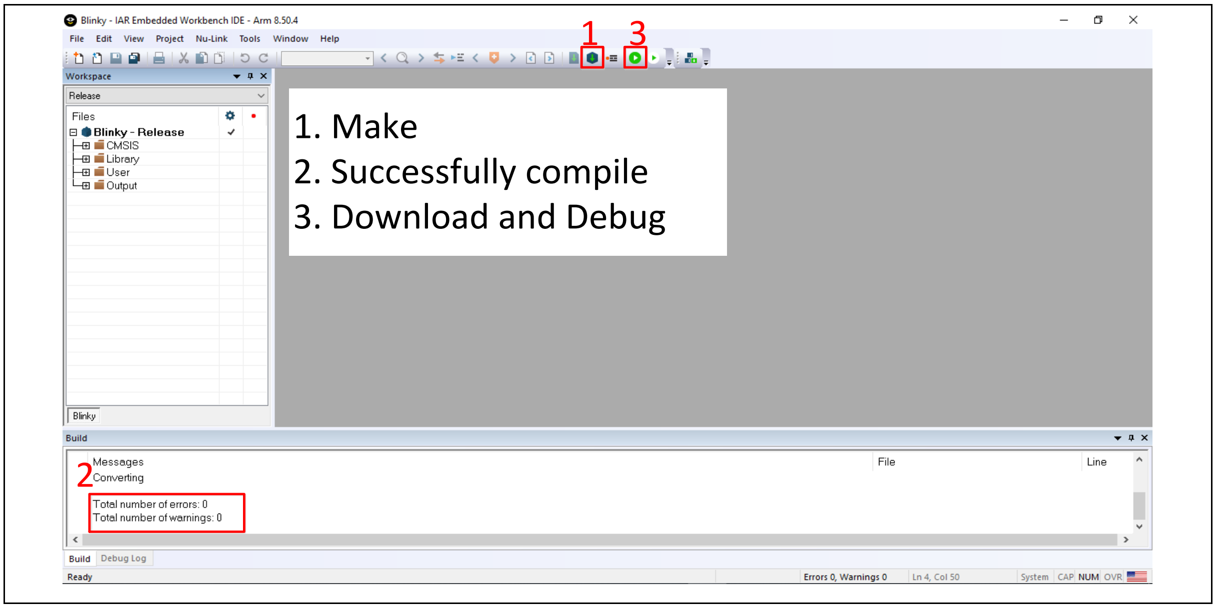



Figure 4-14 Compile and Download the Project

4. Figure 4-15 shows the debug mode under IAR EWARN. Click "**Go**" and the debug message will be printed out as shown in Figure 4-16. The project can be debugged under debug mode by checking source code, assembly language, peripherals' registers, and setting breakpoint, step run, value monitor, etc.

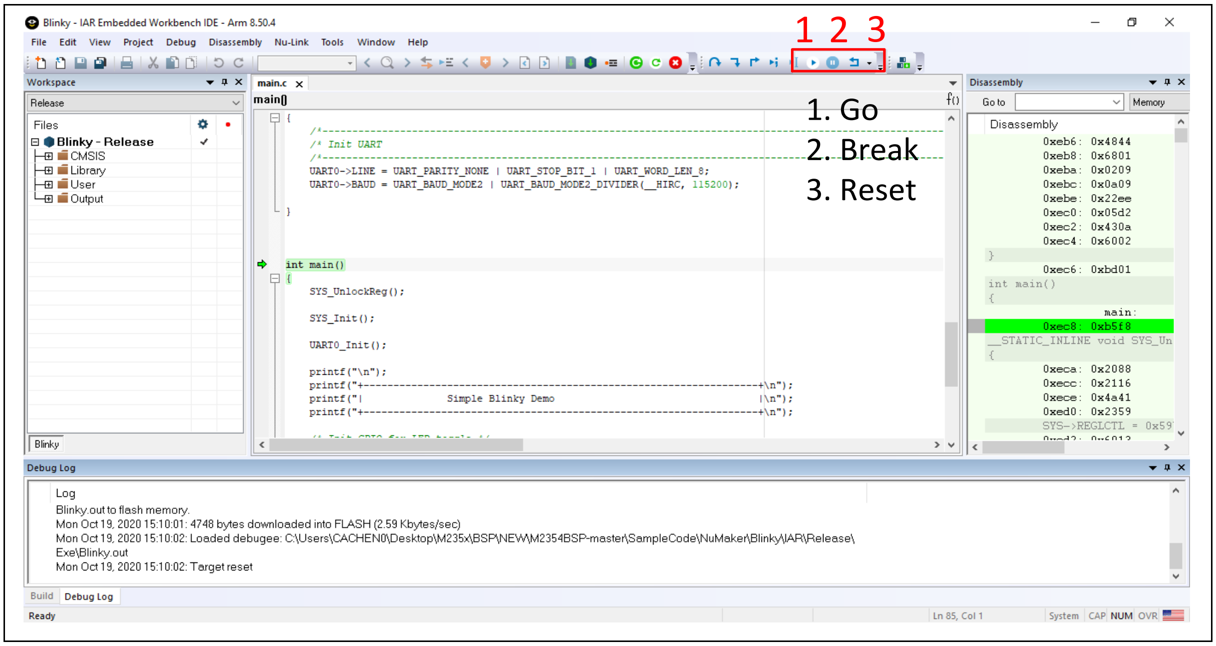



Figure 4-15 IAR EWARM Debug Mode

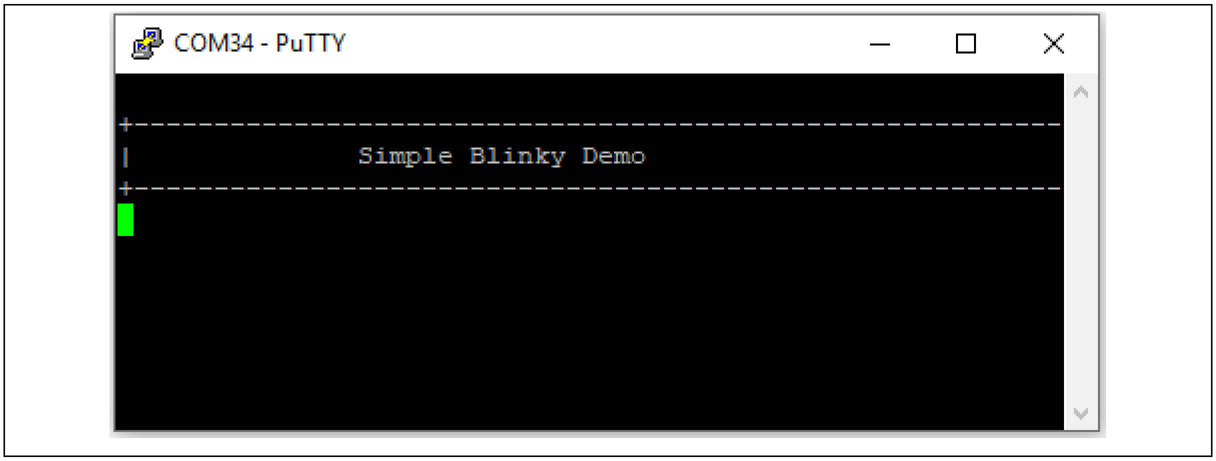



Figure 4-16 Debug Message on Serial Port Terminal Windows

### 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 "Blinky" project by following the steps presented in Figure 4-17and Figure 4-18.

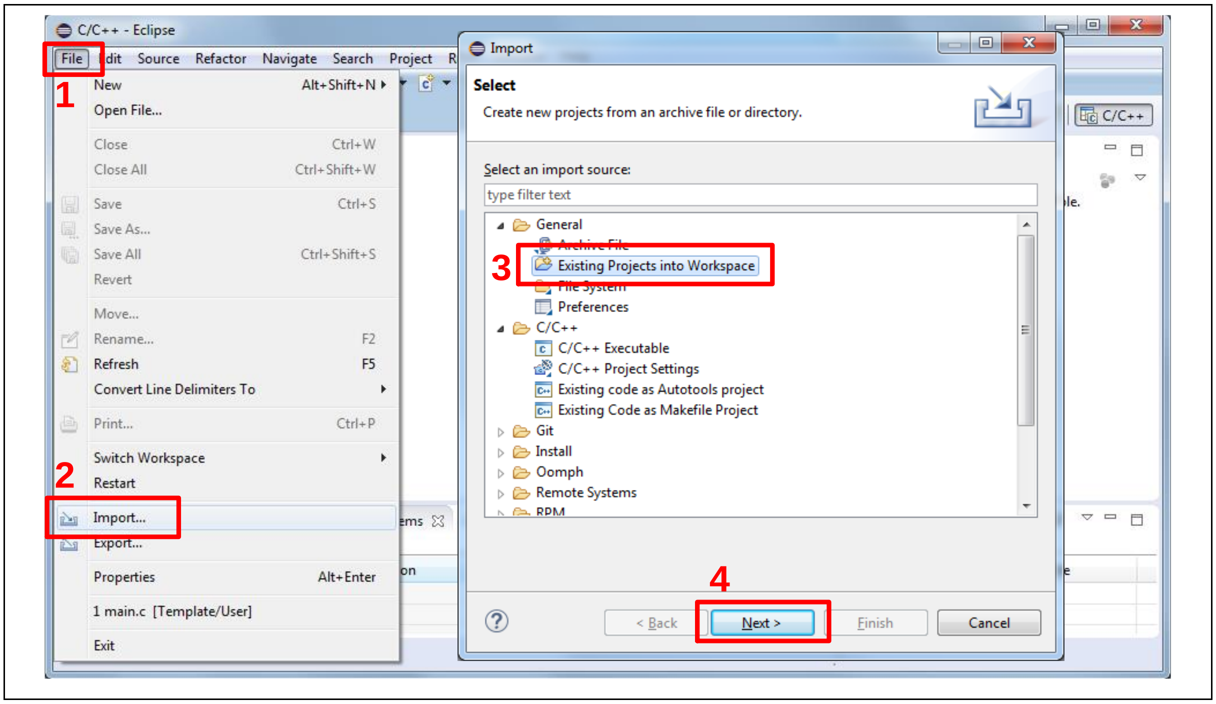



Figure 4-17 Import the Project in NuEclipse

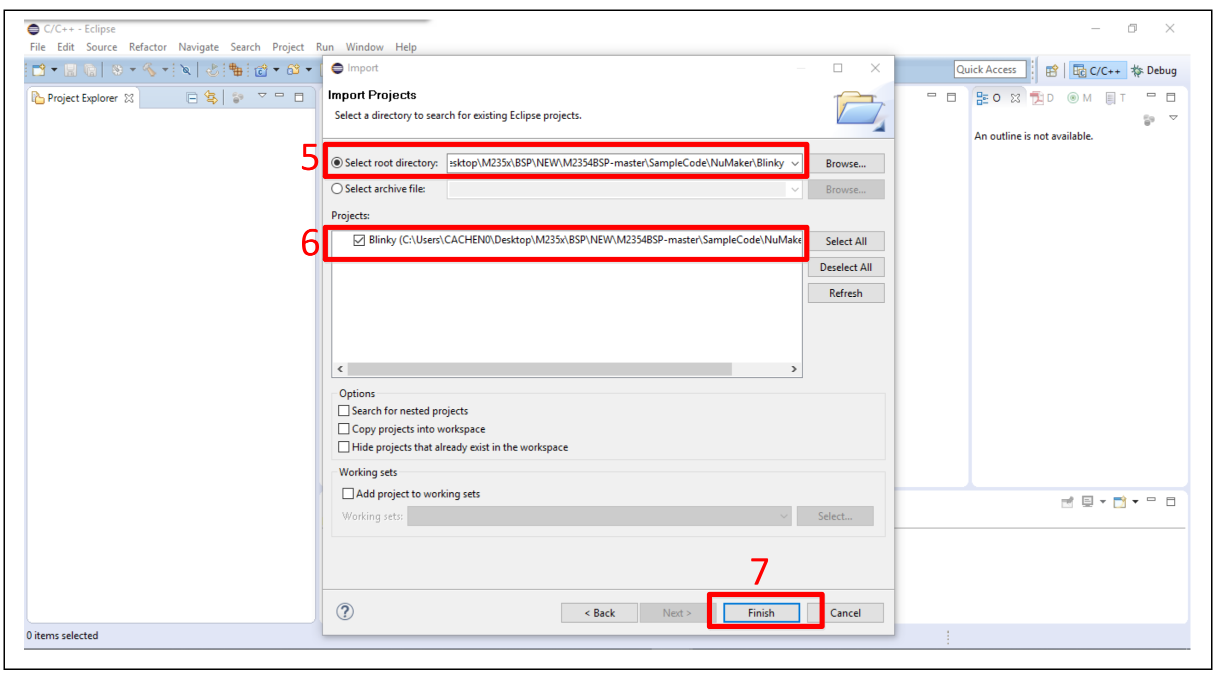



Figure 4-18 Import Projects Windows

3. Click the "Blinky" project and find the project properties as shown in Figure 4-19. Make sure the

settings are the same as settings in Figure 4-20.

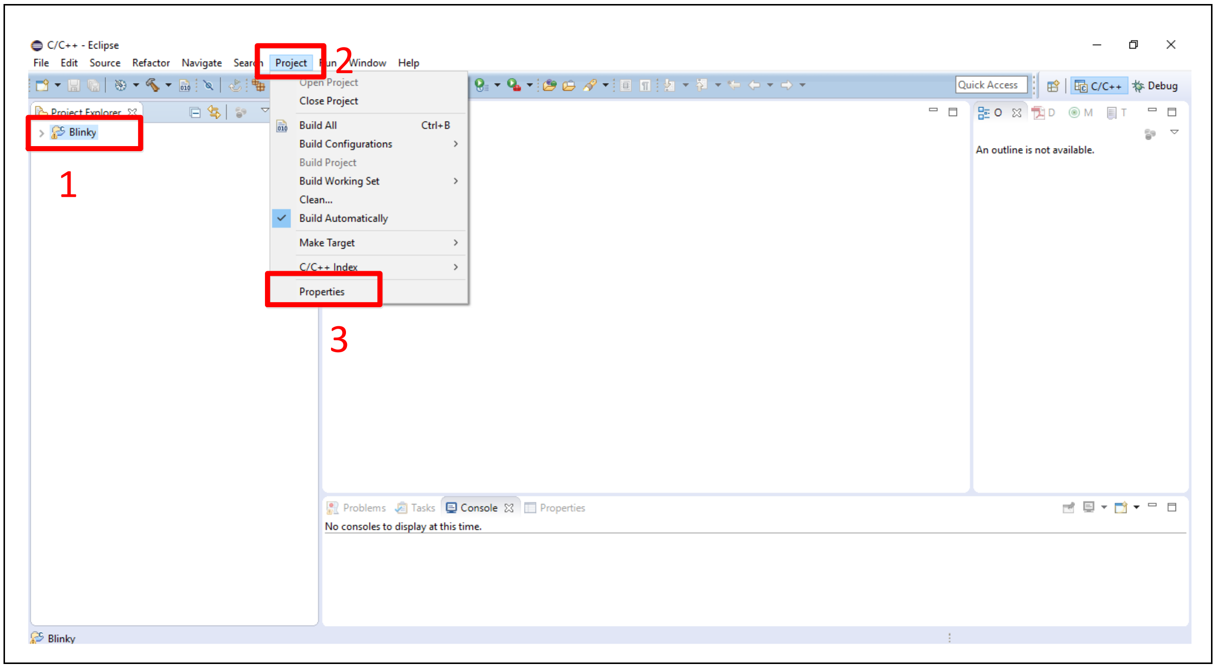



Figure 4-19 Build Project

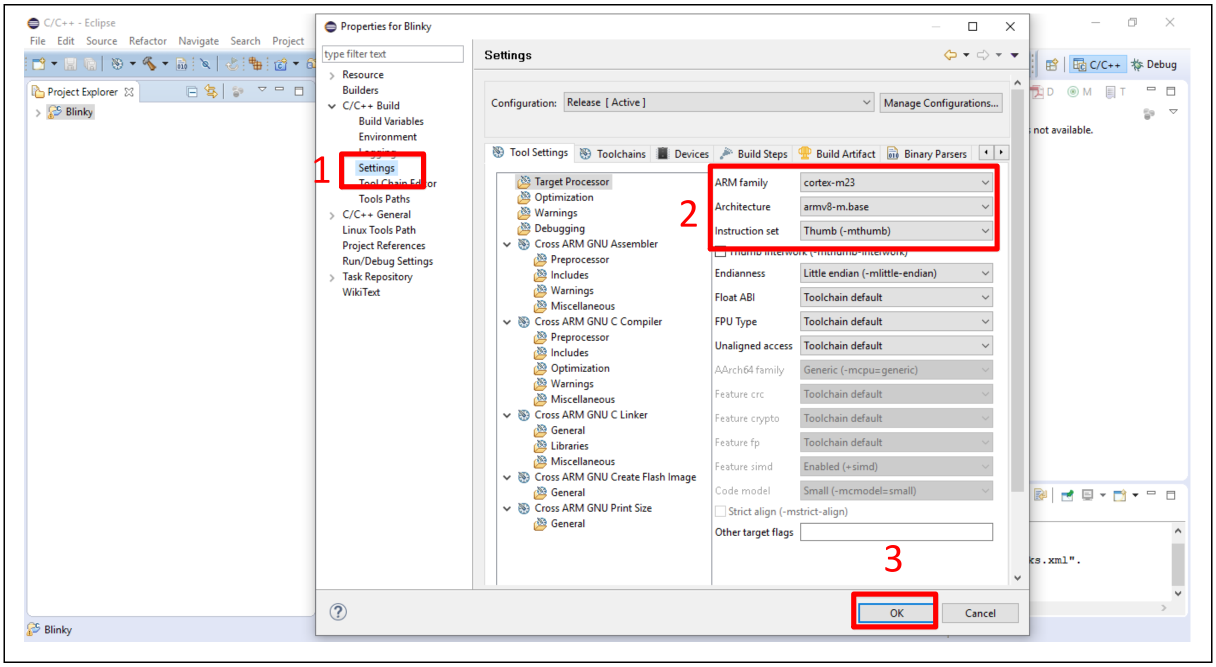



Figure 4-20 Project Properties Settings

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

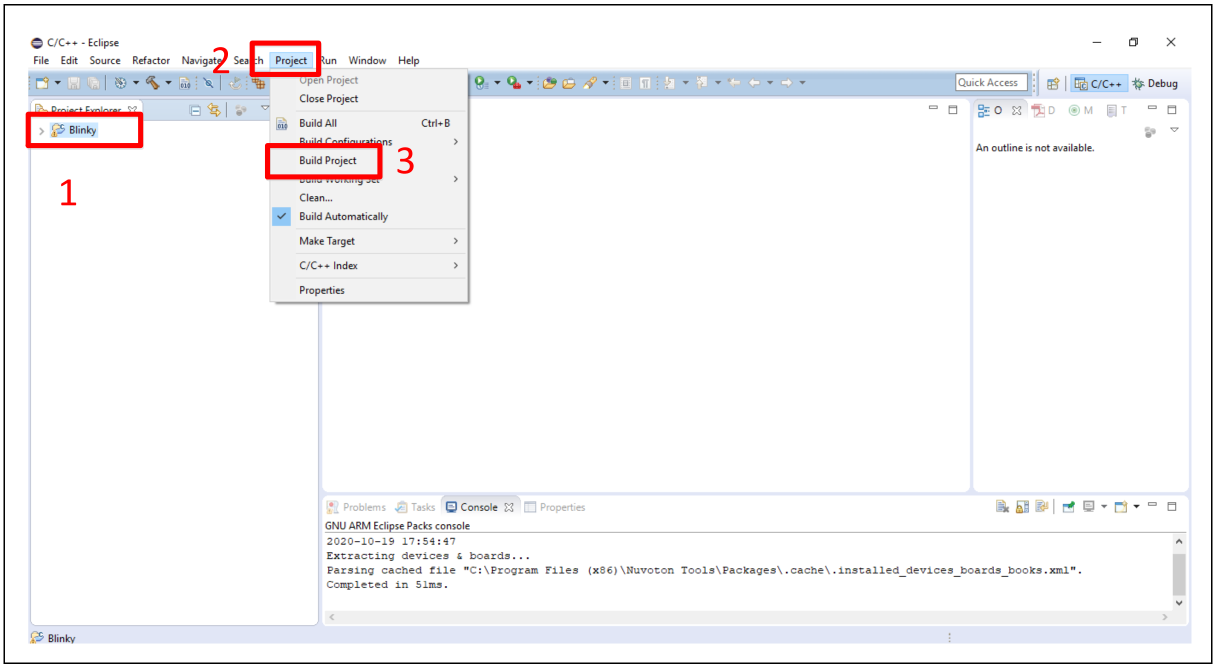



Figure 4-21 Build Project

5. After the project is built, click the “Blinky” project and set the “Debug Configuration” as shown in Figure 4-22. Follow the settings presented in Figure 4-23, Figure 4-24 and Figure 4-25 to enter debug mode.

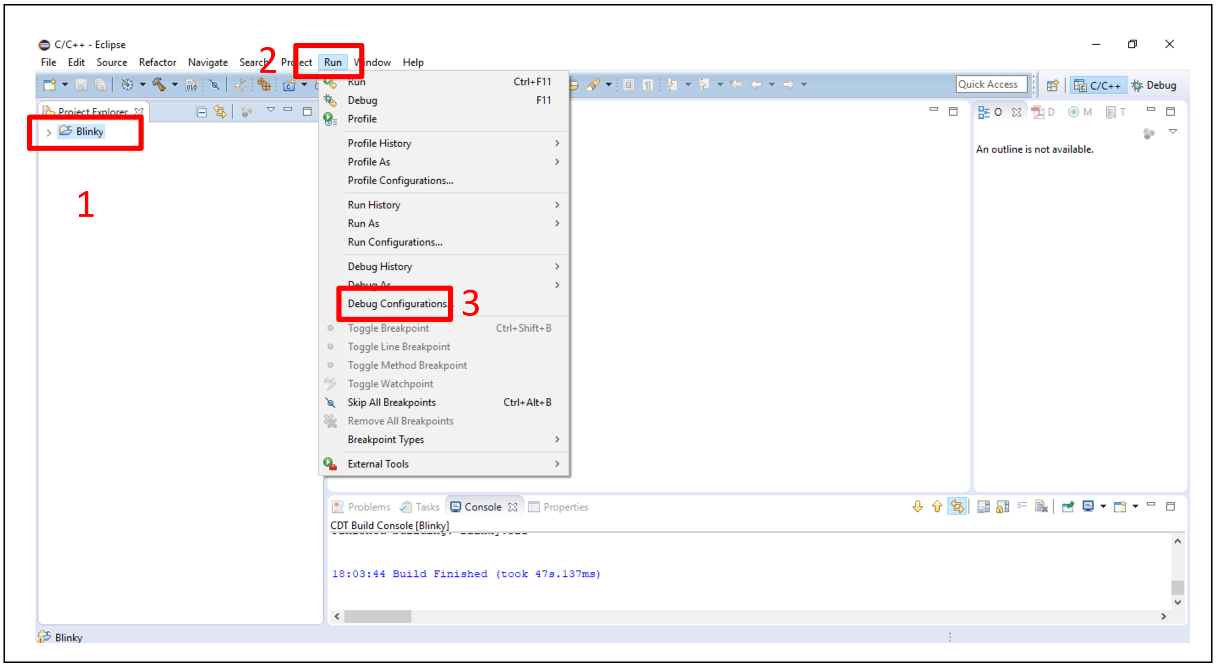
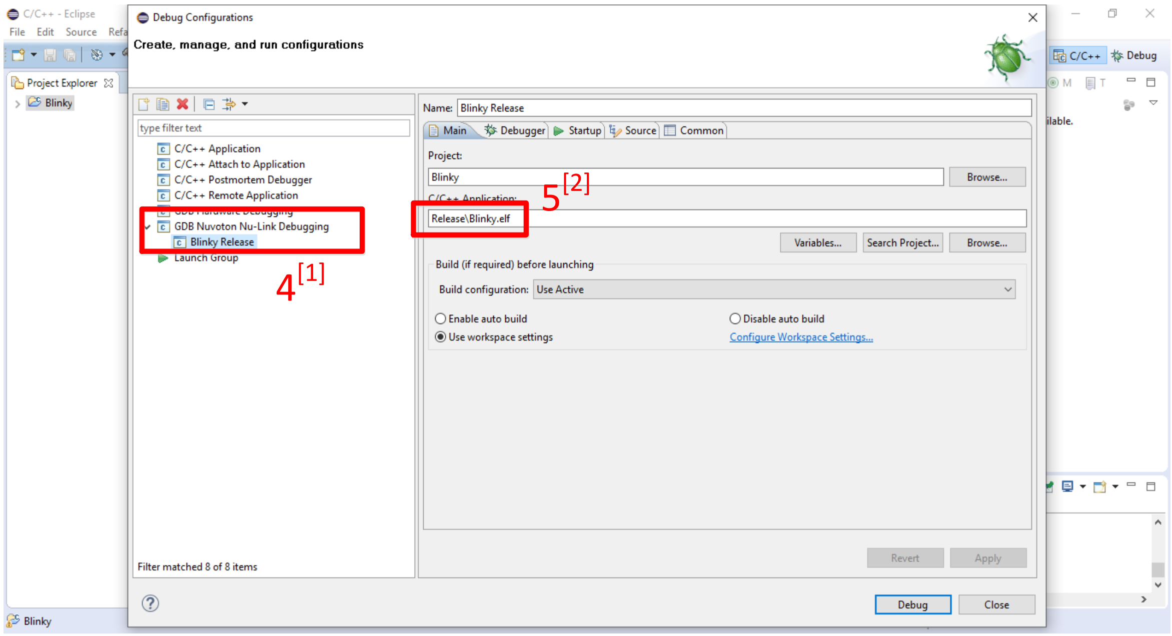



Figure 4-22 Open Debug Configuration




**Note 1:** Double click the "GDB Nuvoton Nu-Link Debugging" to create the subitem.

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

Figure 4-23 Main Tab Configuration

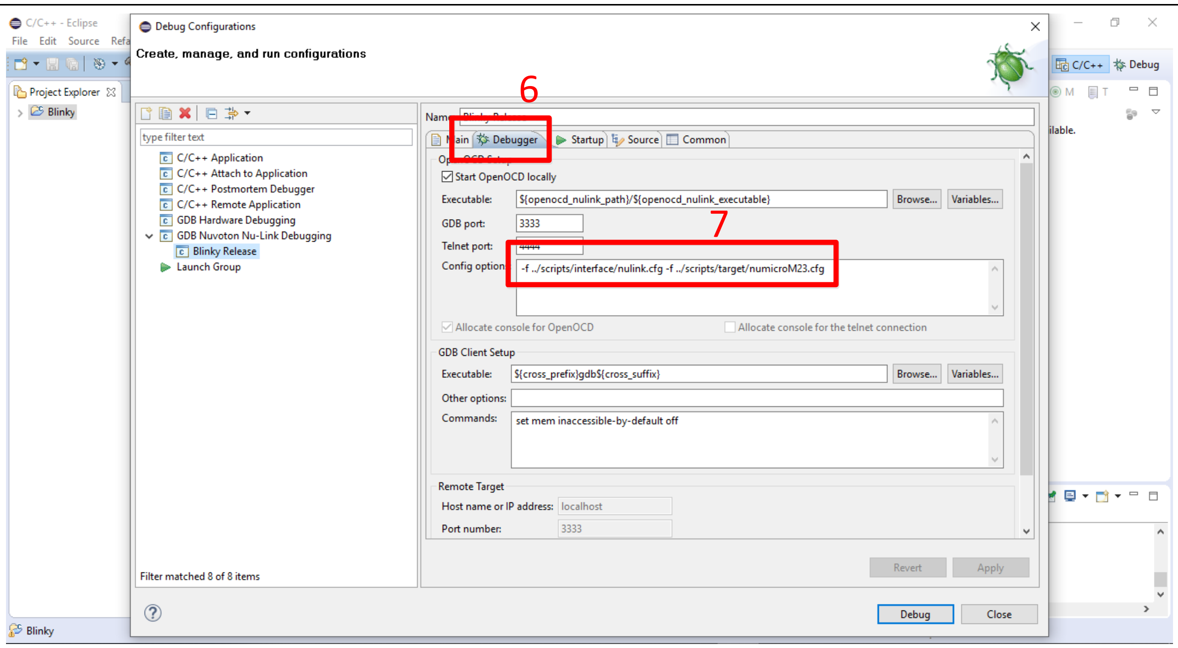
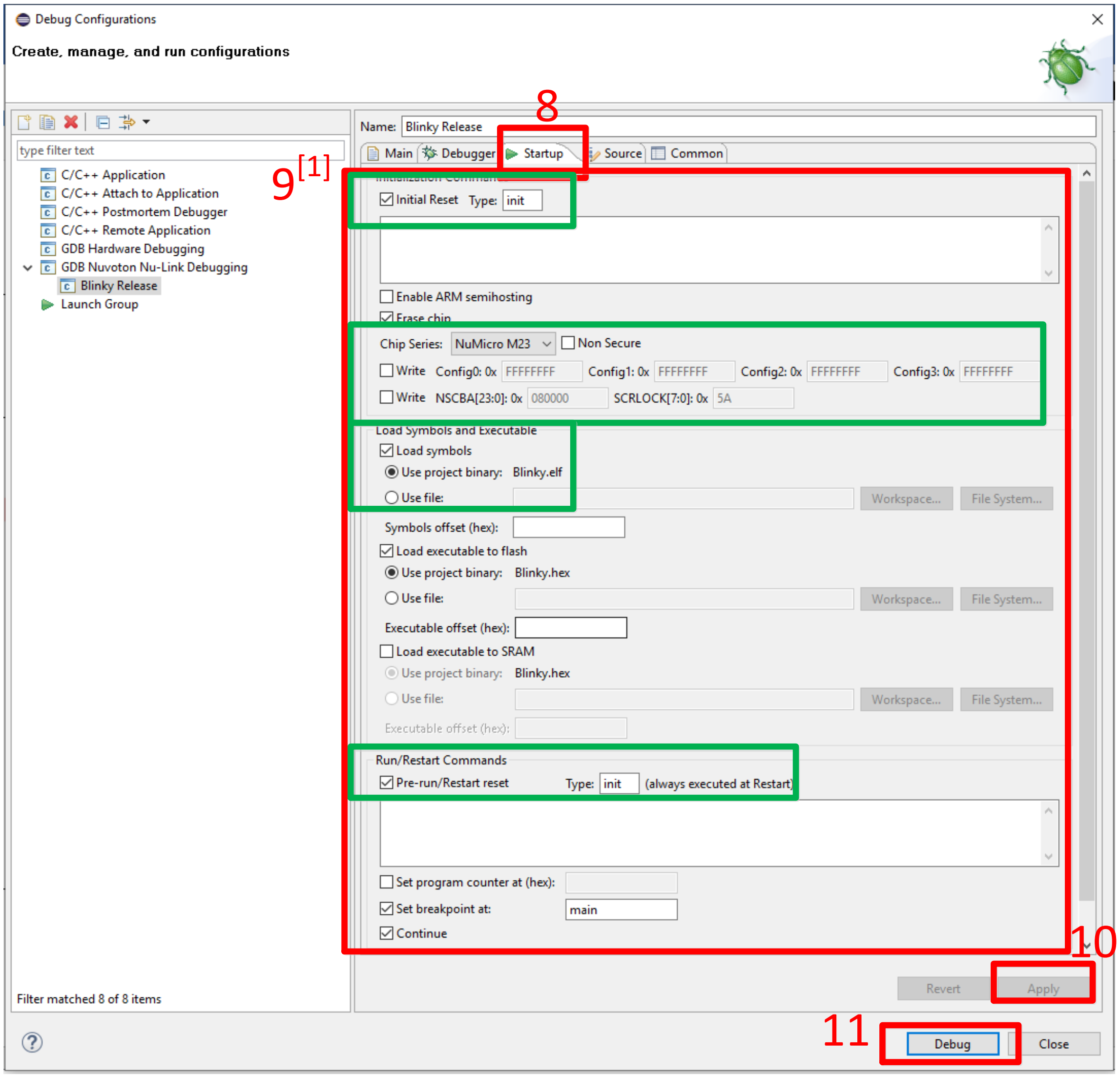



Figure 4-24 Debugger Tab Configuration




**Note:** Please follow the settings highlighted in green triangles and configure other settings depending on the needs.

Figure 4-25 Startup Tab Configuration

6. Figure 4-26 shows the debug mode under NuEclipse. Click "**Resume**" and the debug message will be printed out as shown in Figure 4-27. 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.

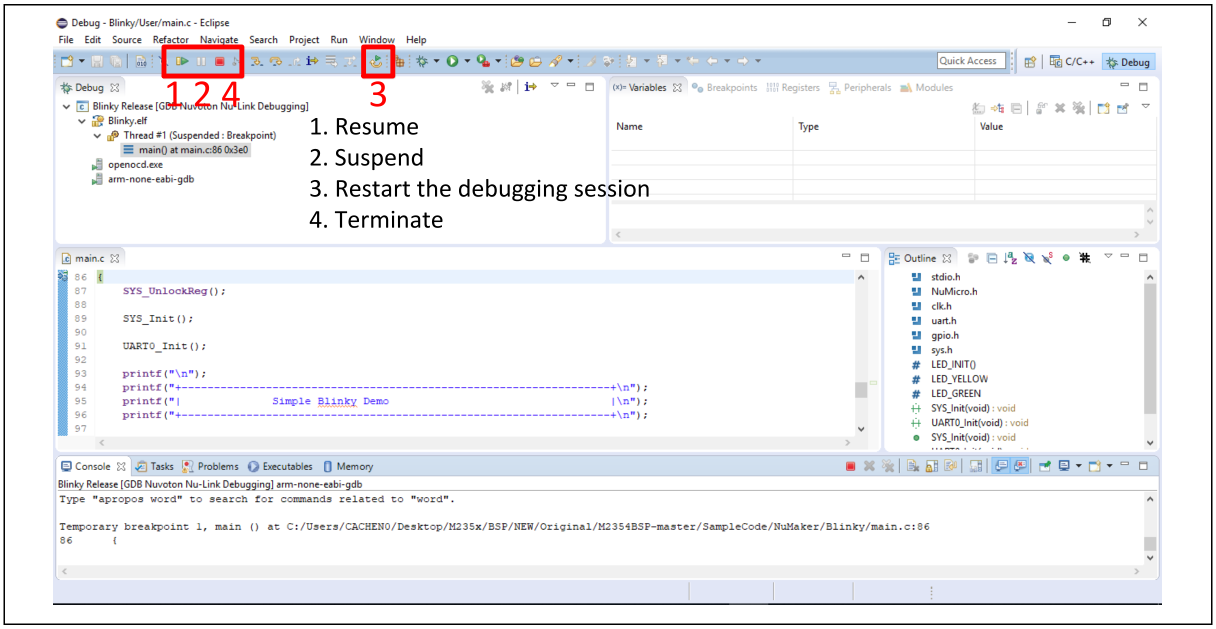



Figure 4-26 NuEclipse Debug Mode

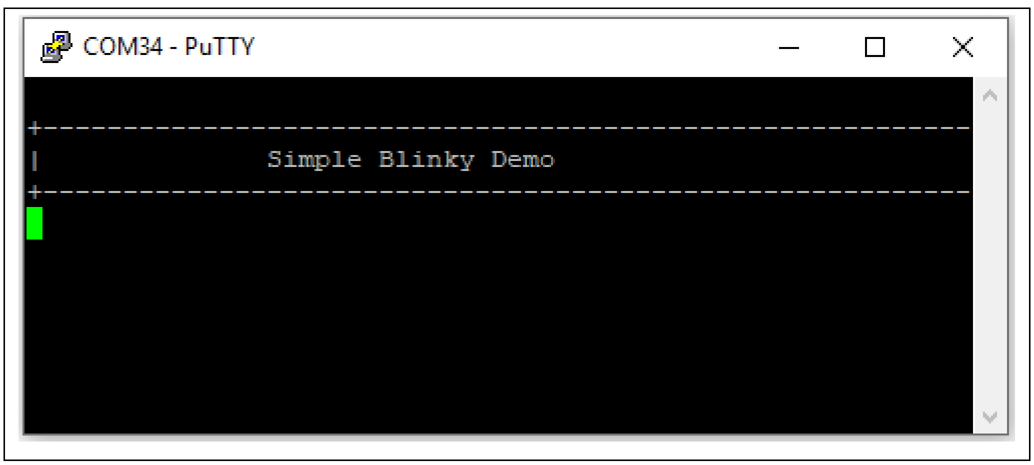



Figure 4-27 Debug Message on Serial Port Terminal Windows

# 5 NUMAKER-IOT-M2354 SCHEMATICS

## 5.1 Nu-Link2-Me

Figure 5-1 shows the Nu-Link2-Me circuit. The Nu-Link2-Me is a debugger and programmer that supports on-line programming and debugging through a SWD interface.

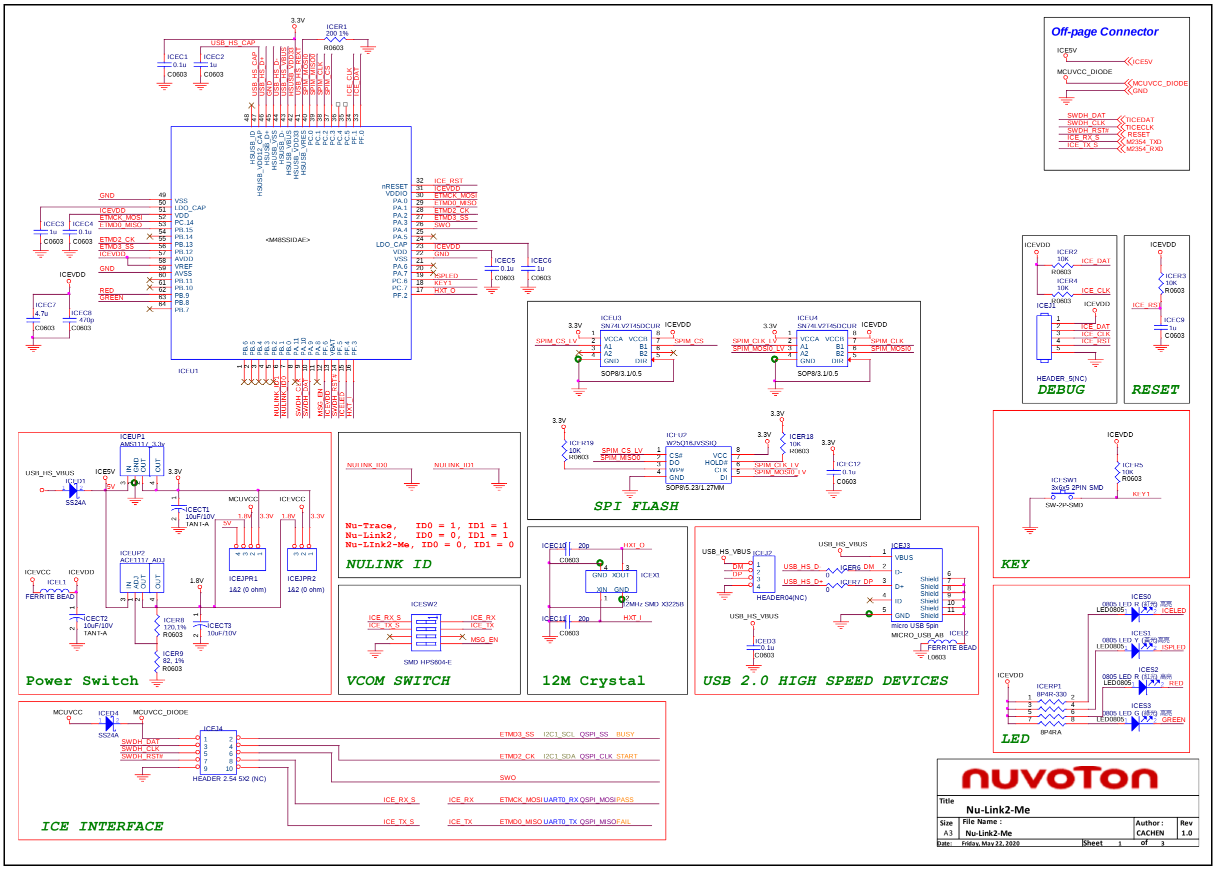


Figure 5-1 Nu-Link2-Me Circuit

## 5.2 M2354 target Board

Figure 5-2 shows the pin assignment of the M2354.

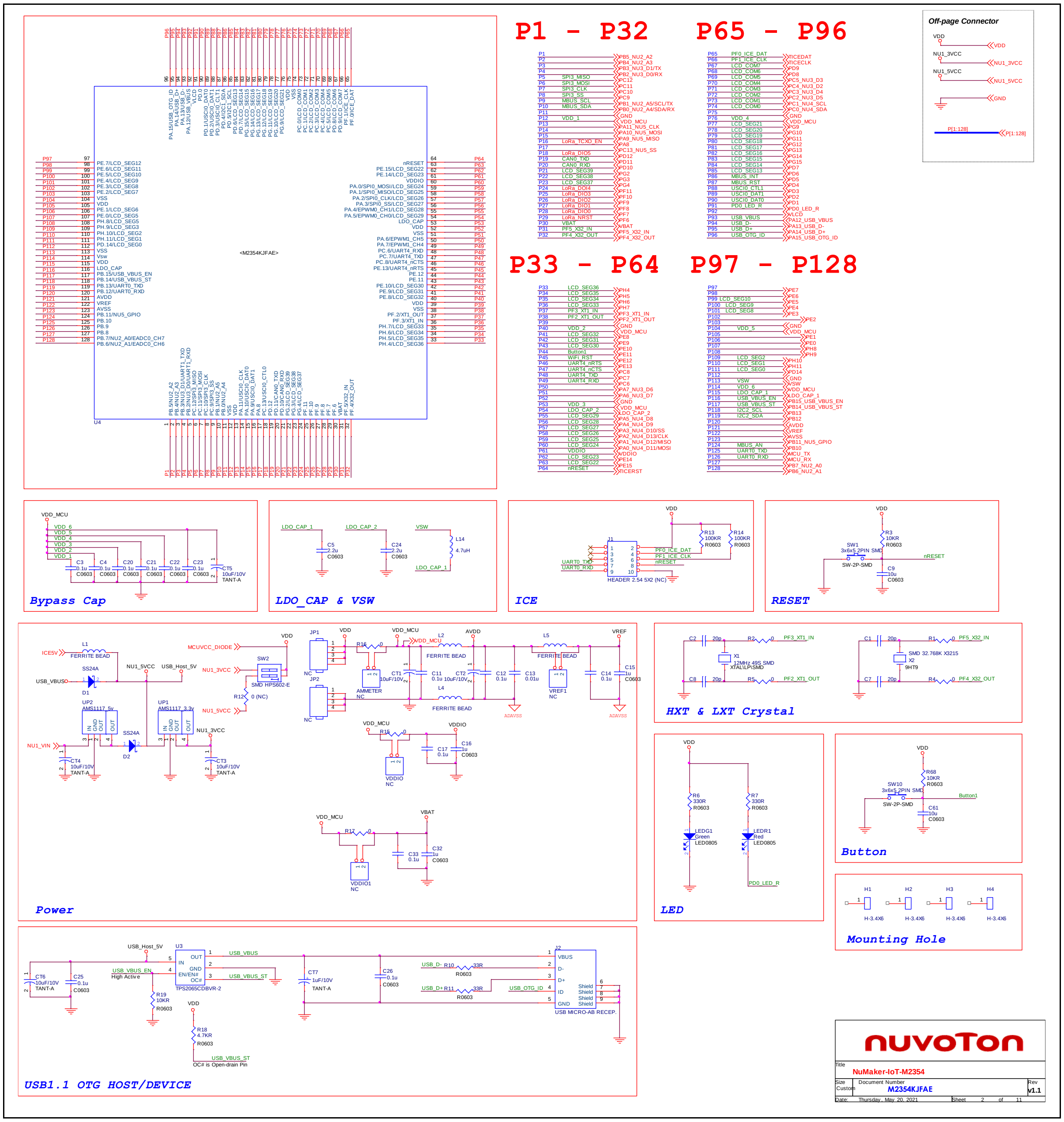



Figure 5-2 M2354 Platform Circuit

## 5.3 Arduino UNO Compatible Interface

Figure 5-3 shows the Arduino UNO compatible interface of the NuMaker-IoT-M2354 board.

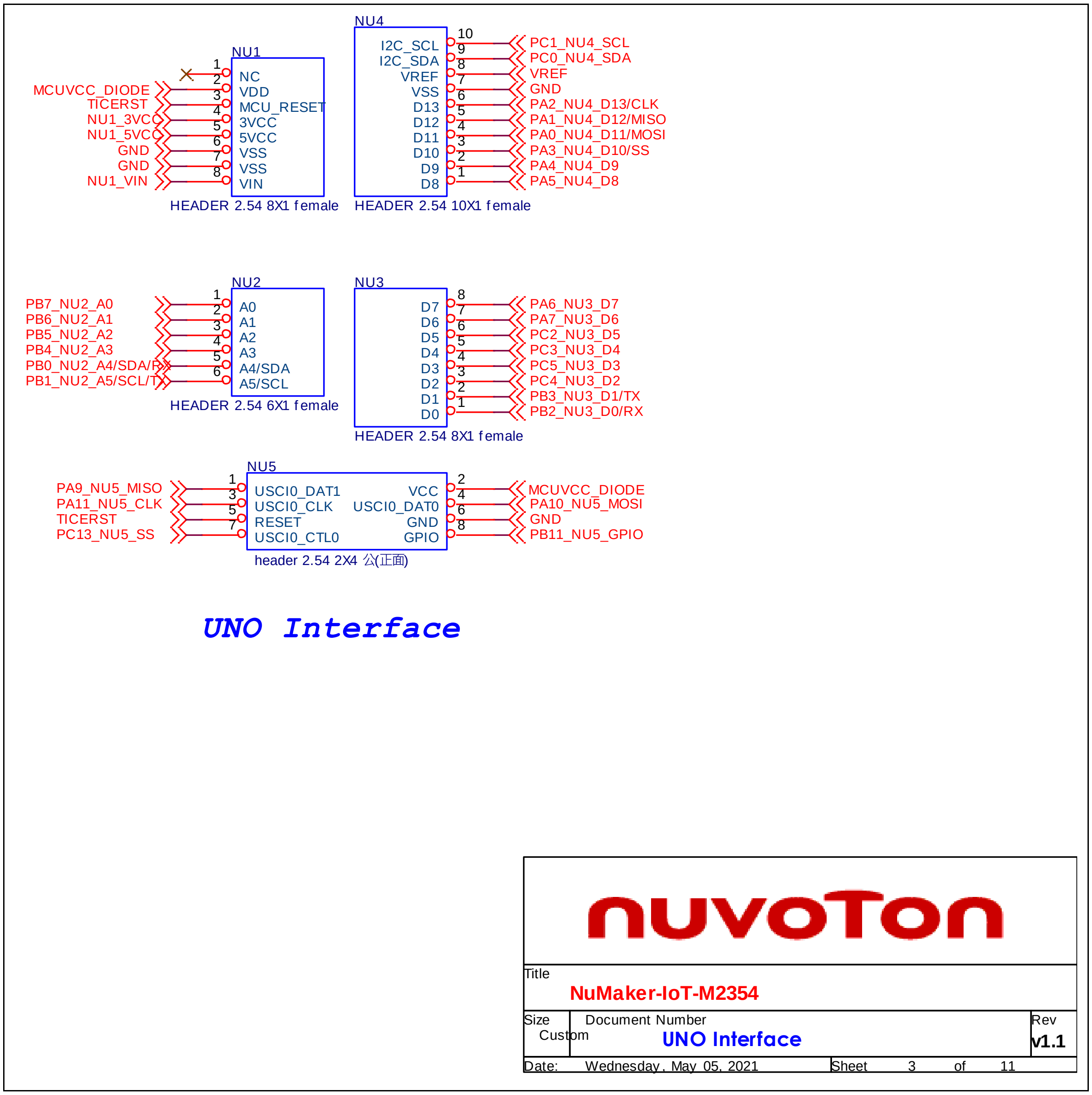



Figure 5-3 Arduino UNO Compatible Interface

## 5.4 Wi-Fi Module

Figure 5-4 shows the Wi-Fi Module (ESP-12) for wireless application on the NuMaker-IoT-M2354 board.

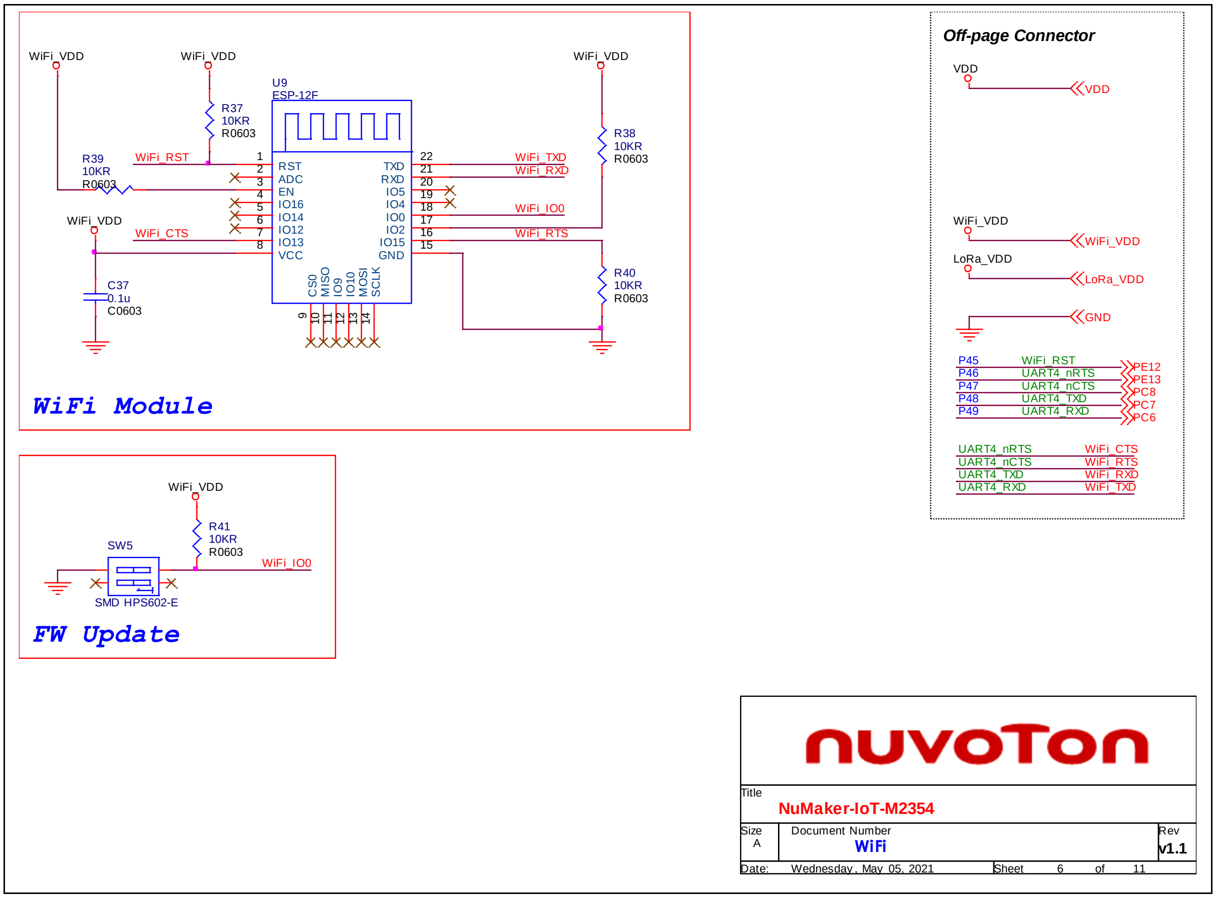



Figure 5-4 Wi-Fi Module Circuit

## 5.5 LoRa Module

Figure 5-5 shows the LoRa module of NuMaker-IoT-M2354.

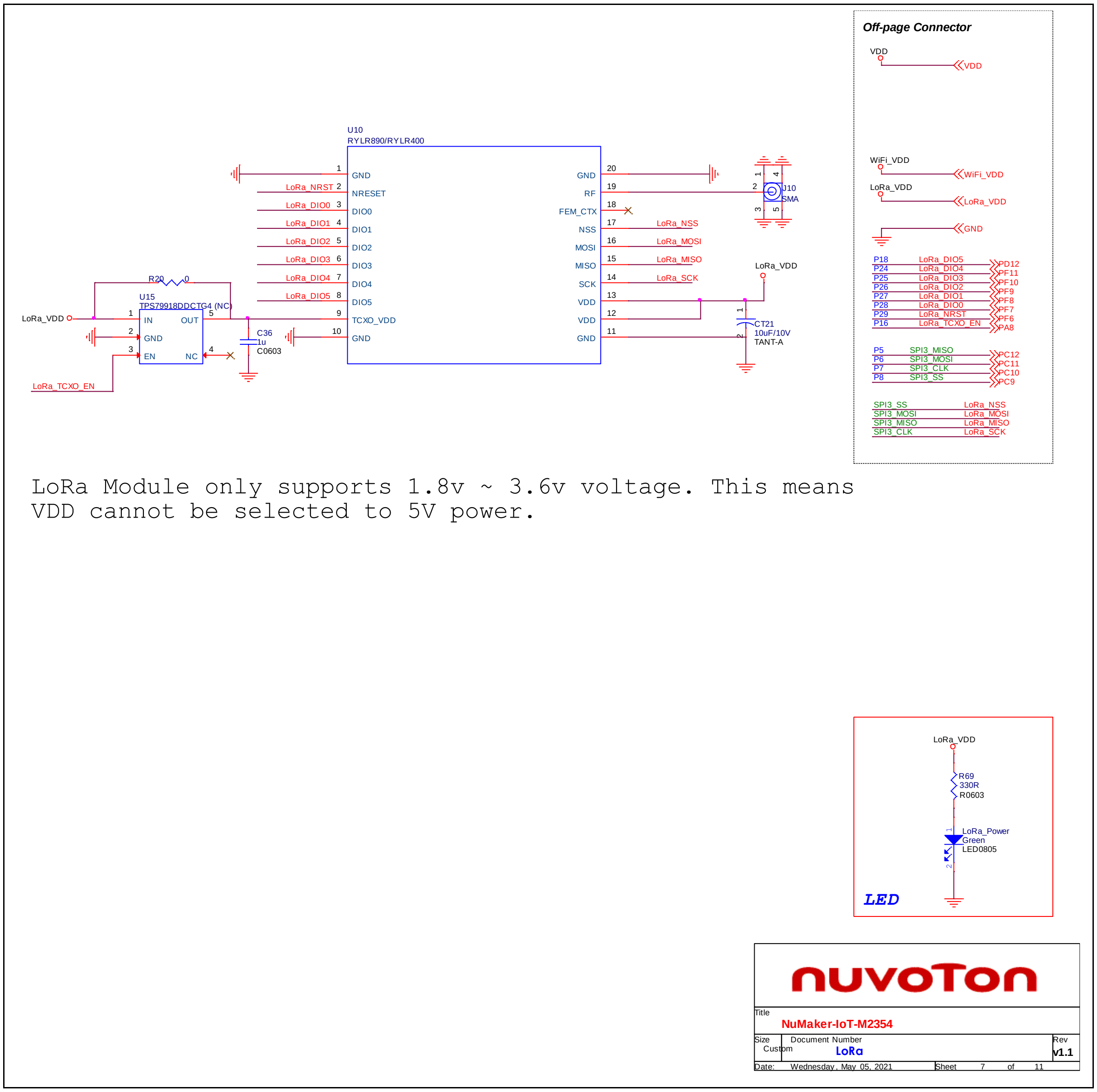



Figure 5-5 LoRa Module Circuit

## 5.6 On-board Sensors

Figure 5-6 shows the on-board sensors of NuMaker-IoT-M2354.

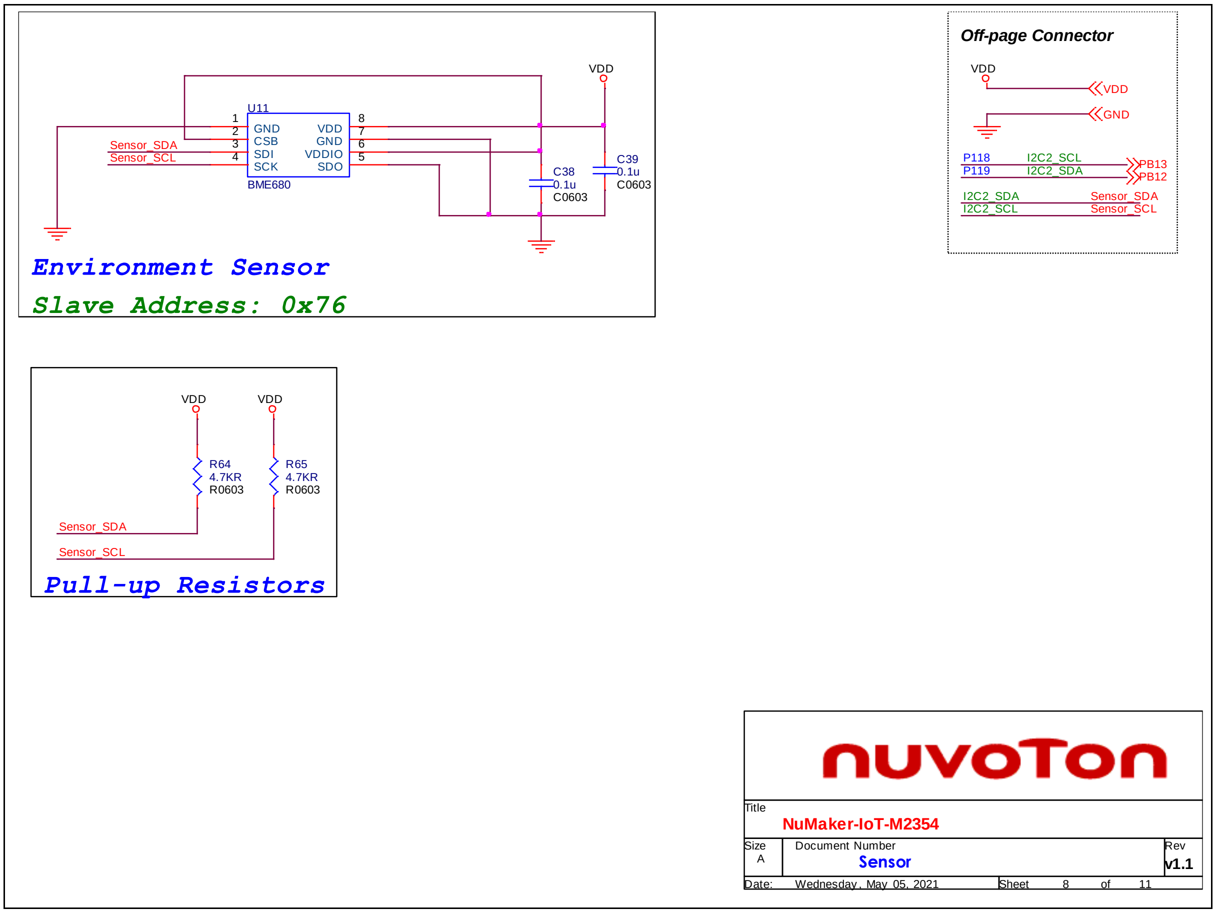



Figure 5-6 on-board sensors Circuit

## 5.7 CAN and RS485 Connector

Figure 5-7 shows the CAN and RS485 connector of NuMaker-IoT-M2354.

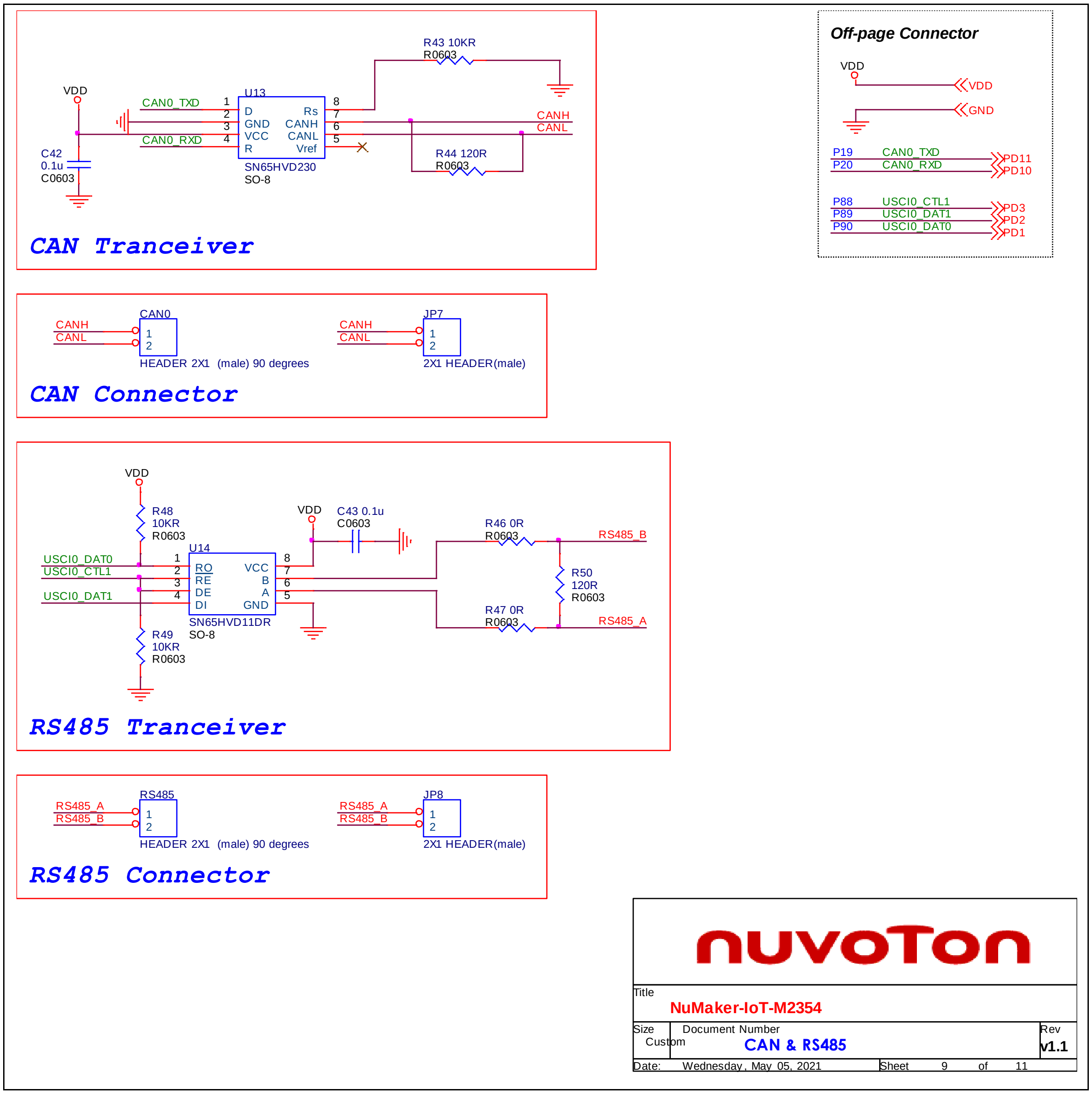



Figure 5-7 CAN and RS485 Connector Circuit

## 5.8 mikroBUS Interface

Figure 5-8 shows the mikroBUS on the NuMaker-IoT-M2354 board.

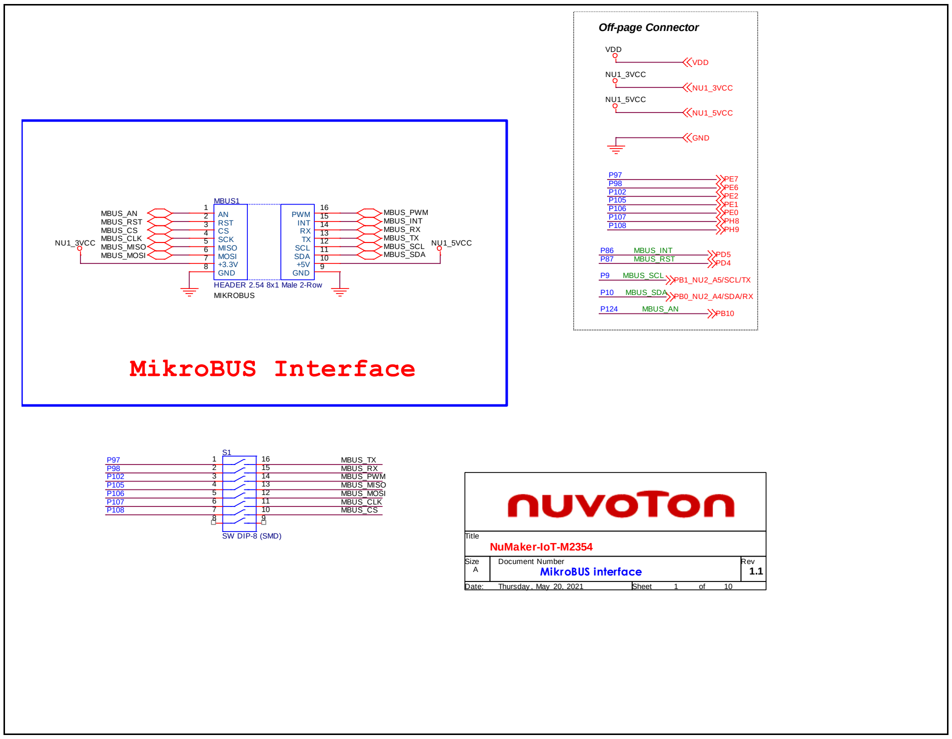



Figure 5-8 mikroBUS Circuit

## 5.9 LCD interface

Figure 5-9 shows the LCD connective interface and LCD panel for display application on the NuMaker-IoT-M2354 board.

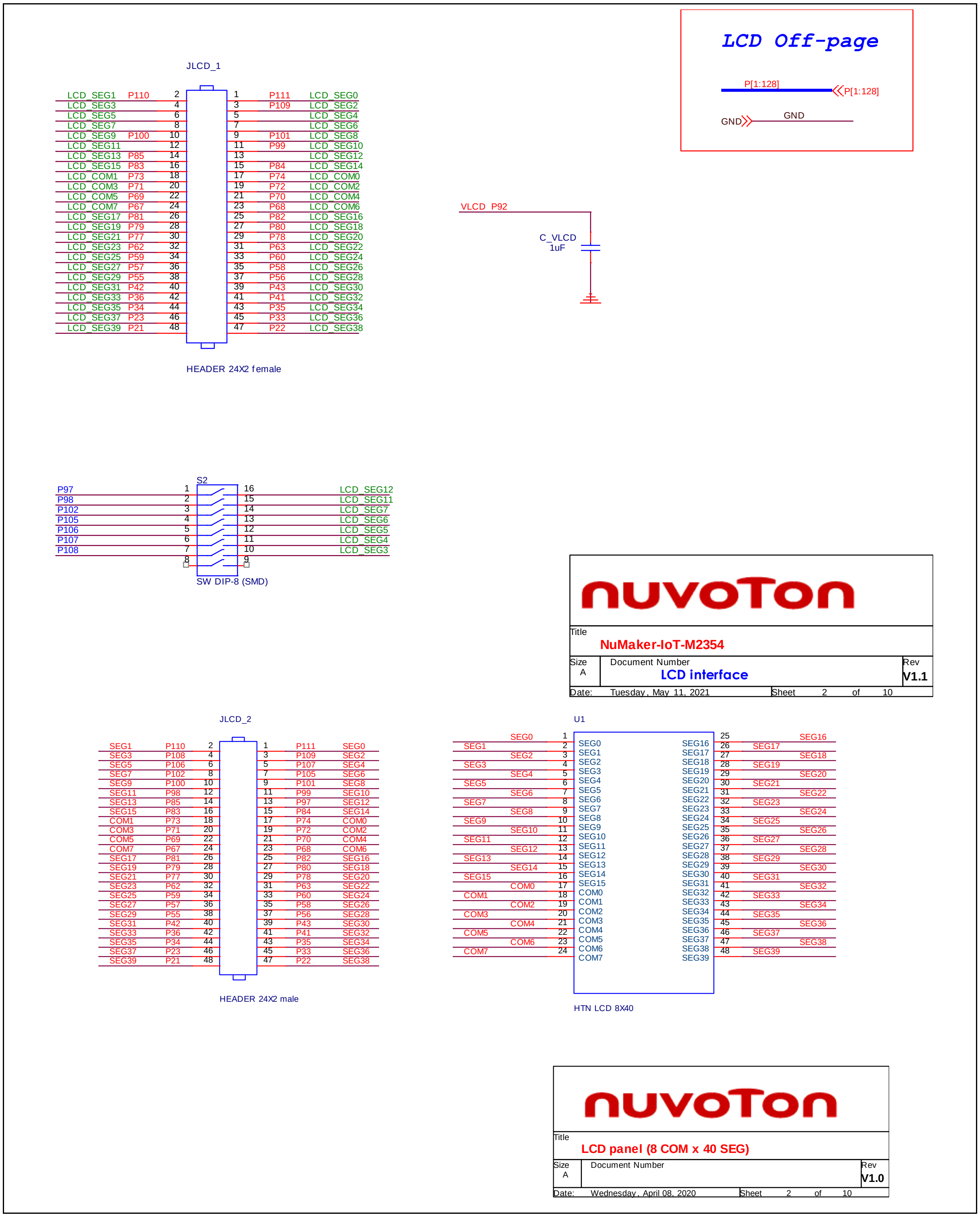



Figure 5-9 LCD interface Circuit

## 5.10 Power Connector of On-board Module

Figure 5-10 shows the on-board module power of NuMaker-IoT-M2354.

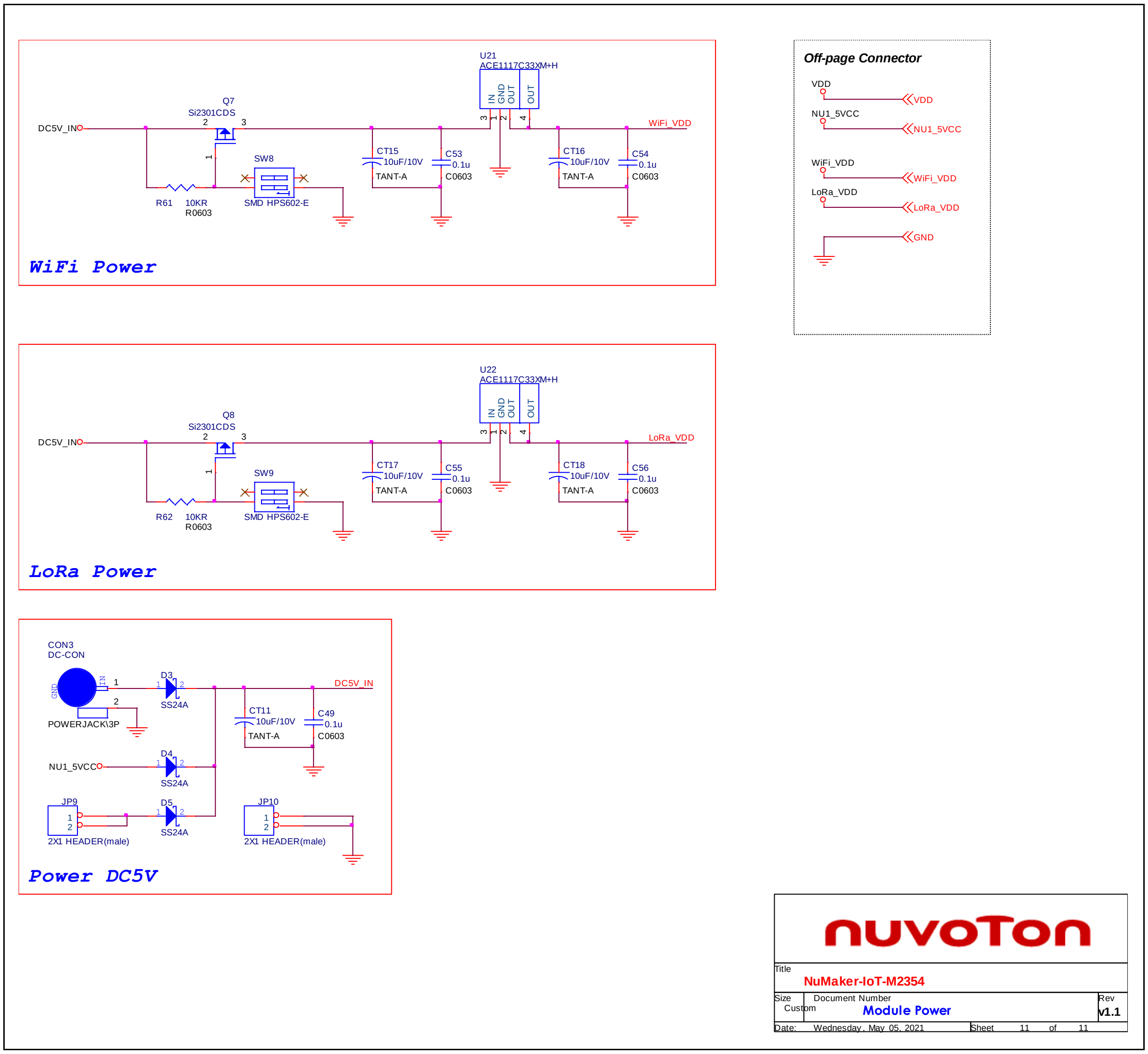



Figure 5-10 on-board modules power of NuMaker-IoT-M2354

## 5.11 PCB Placement

Figure 5-11 and Figure 5-12 show the front and rear placement of NuMaker-IoT-M2354.

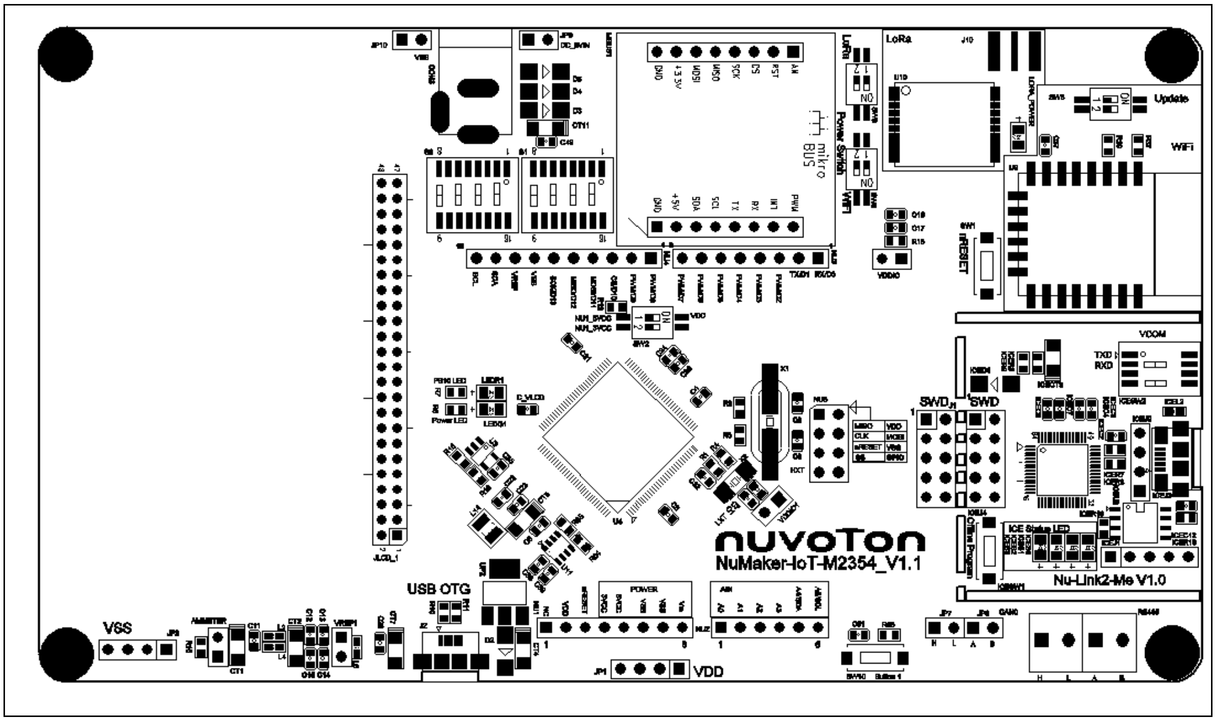



Figure 5-11 Front Placement

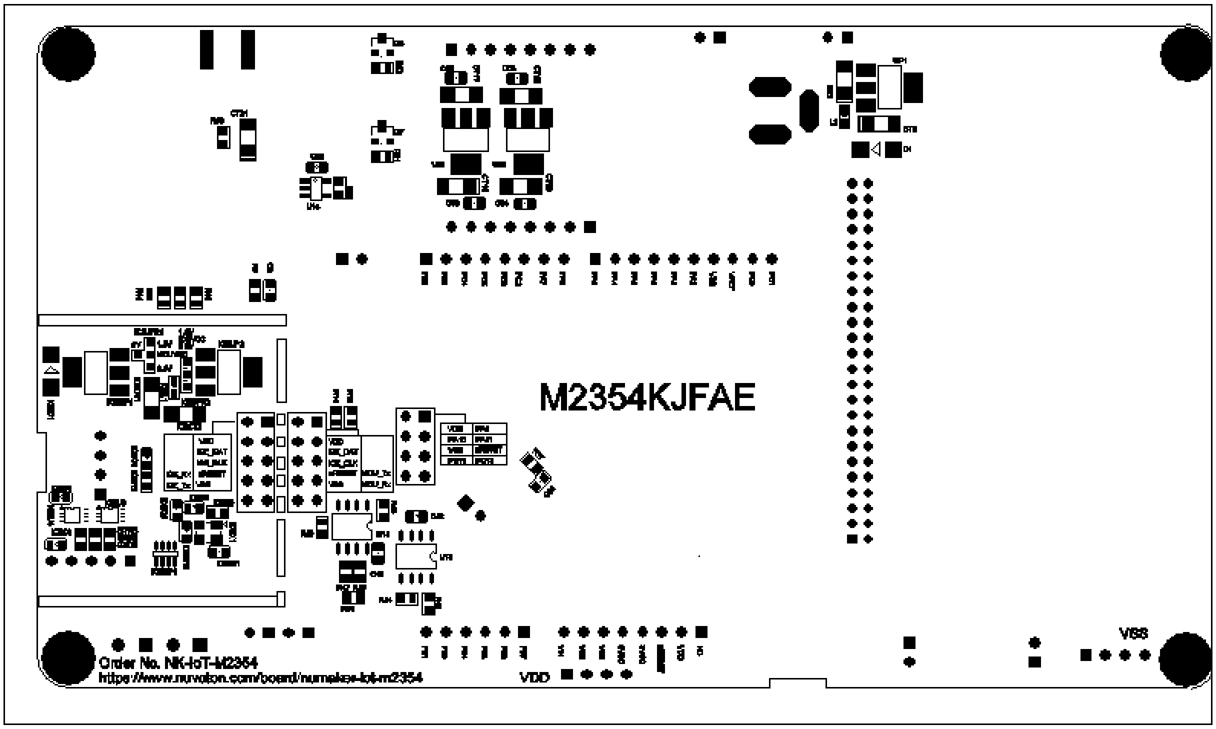



Figure 5-12 Rear Placement

# 6 REVISION HISTORY

| Date | Revision | Description |
|---|---|---|
| 2021.7.16 | 1.00 | • Initial version |

## Important Notice

**Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".**

**Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.**

**All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.**