

ARM® Cortex®-M
32-bit Microcontroller

NuMicro® Family
NuMaker-PFM-M2351 Board
Quick Start Guide

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1 OVERVIEW

This document describes the firmware development environment used to build an application in the NuMaker-M2351 board and how to use board supporting package (BSP) including necessary drivers to develop applications with M2351. The guidelines on how to build the sample code of BSP are also included.

2 BOARD SUPPORTING PACKAGE (BSP)

The BSP contains M2351 driver, library and sample code. The driver is based on CMSIS. The libraries are smart card library and USB host library. All peripheral sample codes are provided to help user to understand how they work and how to use them. Furthermore, the TrustZone sample code is also included in the BSP. The detailed information of the BSP materials can be found in a readme file in the BSP root directory.

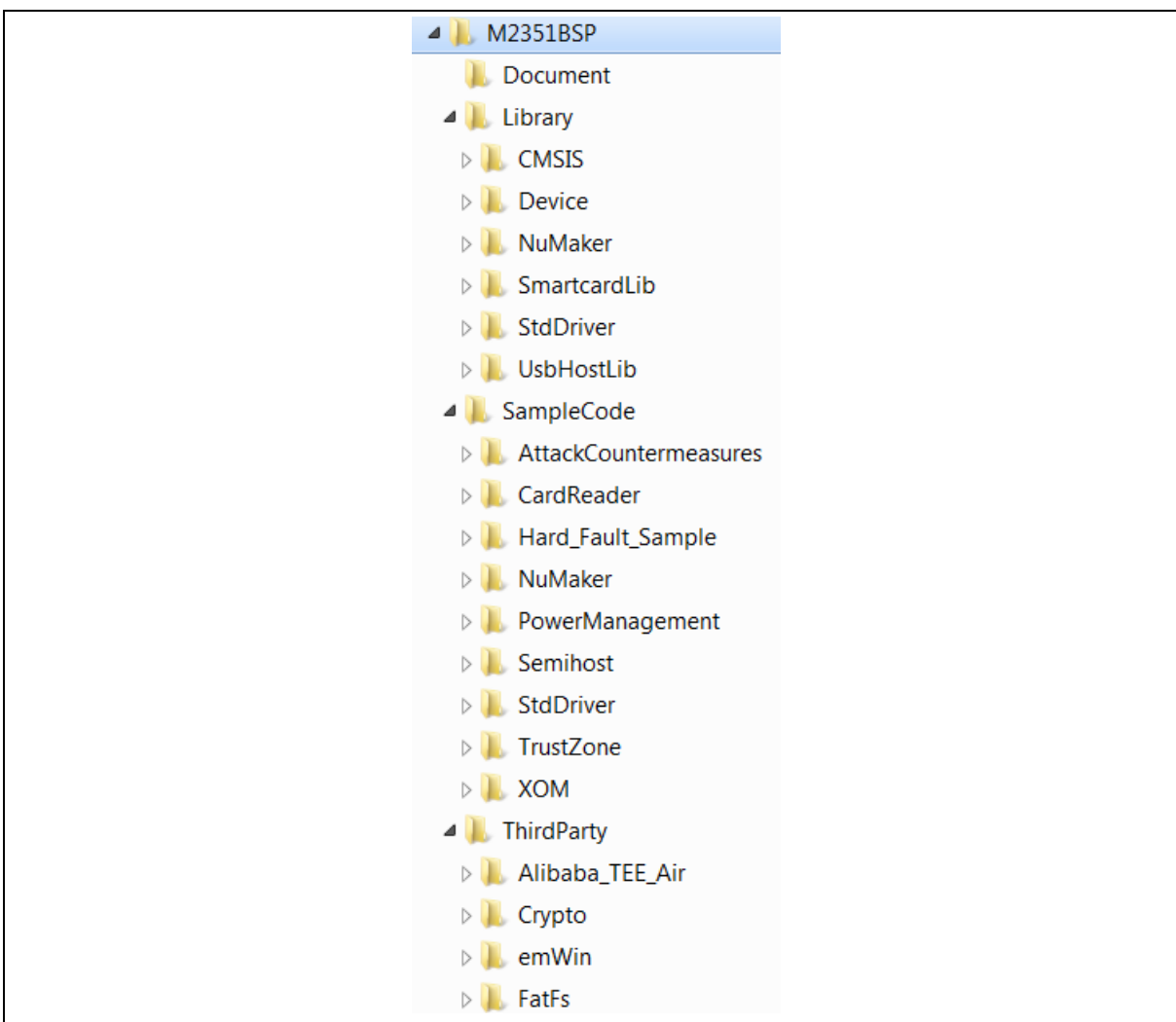


Figure 2-1 M2351 BSP Folder Structure

3 INSTALLING TOOL DRIVERS

The NuMaker-M2351 board has built in with Nuvoton Nu-Link ICE on board. By default KEIL, IAR and GCC project settings, the Nu-Link ICE is used to download and debug the sample code. In order to let Nu-Link ICE works with the IDE, user needs to install the Nu-Link KEIL/IAR or OpenOCD driver and connected to the Nu-Link ICE via the USB cable.

In addition, if user wants to M2351 back to factory default state, ICP Programming Tool should be installed and connected with Nu-Link ICE via USB cable.

Since the M2351 architecture is based on Arm®-v8M with TrustZone® inside. It is recommended to use KEIL MDK Plus/Pro V5.20 or IAR EWARM V8.30.1 or GNU Nuvoton Eclipse V1.01.010 and later version.

Moreover, Nuvoton has provided free-to-use IDE environment which is called Free Keil MDK Nuvoton Edition for M0/M0+/M23. It is free development IDE tool for all M0/M0+/M23 based MCU of Nuvoton. Users can go to <https://www.nuvoton.com/tool-and-software/ide-and-compiler/get-keil-mdk-lic/> to receive a valid license to activate MDK for Nuvoton Cortex-M0/M0+/M23 family. To install and activate Free Keil MDK Nuvoton Edition for M0/M0+/M23, please follow the steps as below:

- Link to <https://www2.keil.com/nuvoton/M0-M23>.
User can download Free Keil MDK Nuvoton Edition for M0/M0+/M23 by clicking “Download MDK Core”.

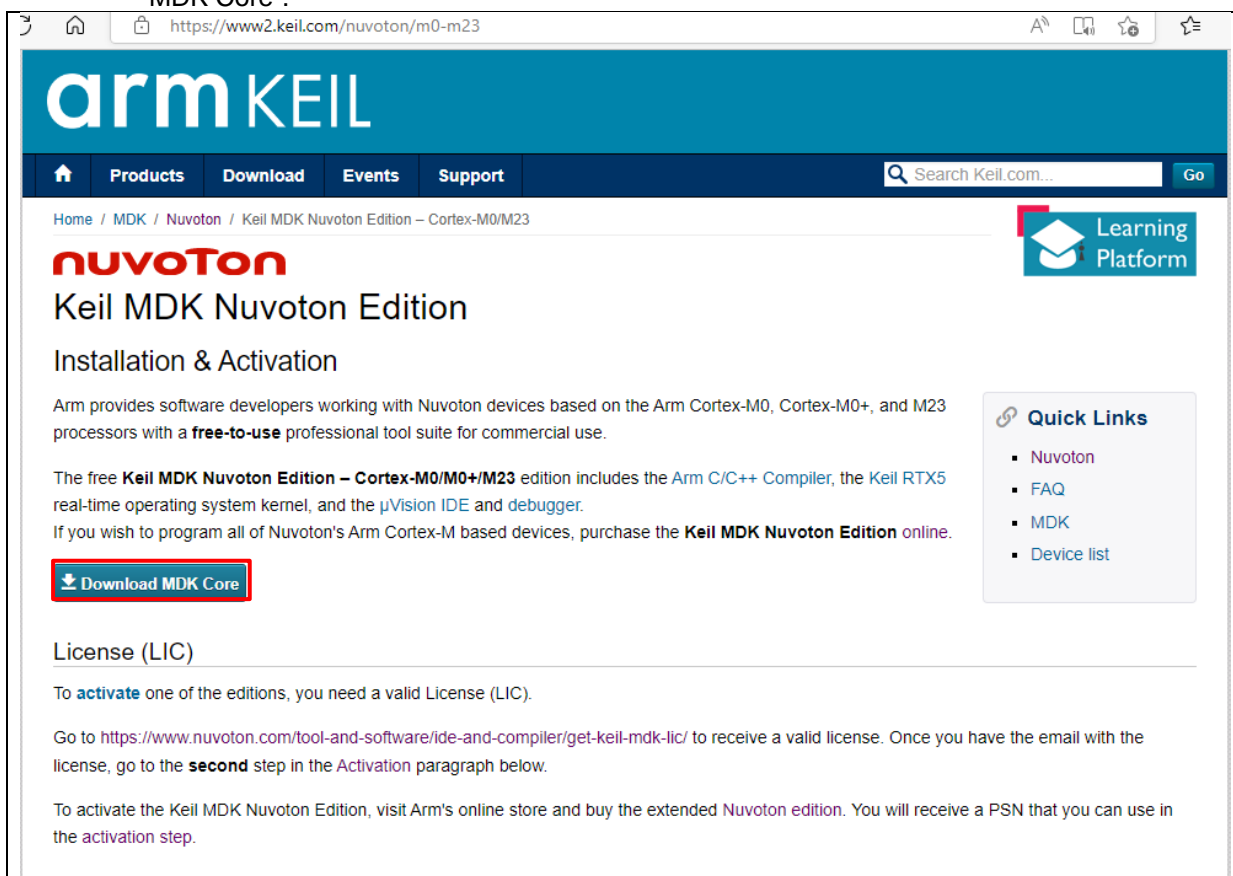


Figure 3-1 Download Free Keil MDK Nuvoton Edition for M0/M0+/M23

- After installing Free Keil MDK Nuvoton Edition for M0/M0+/M23 done, open Keil MDK and select “File→License Management...” to enter license management.

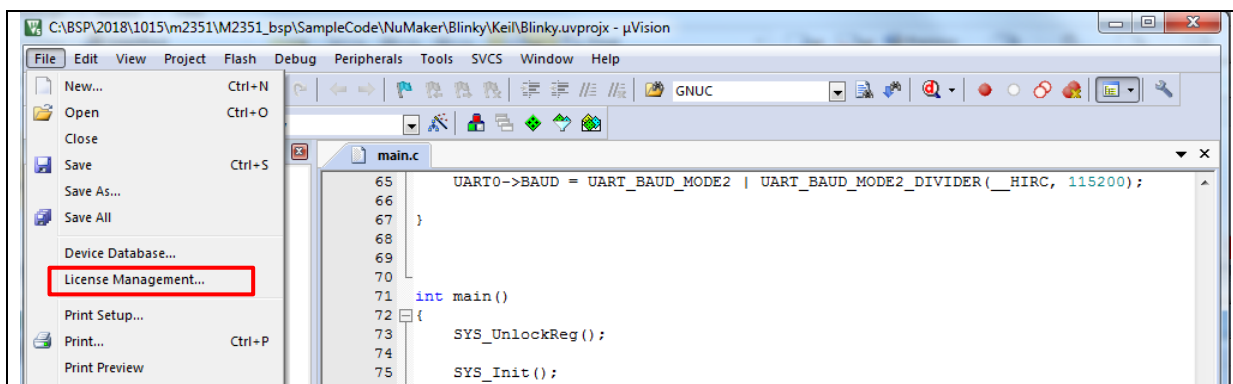


Figure 3-2 Open Keil MDK and Enter License Management

- Select “Single-User License” tab, and copy “CID”.

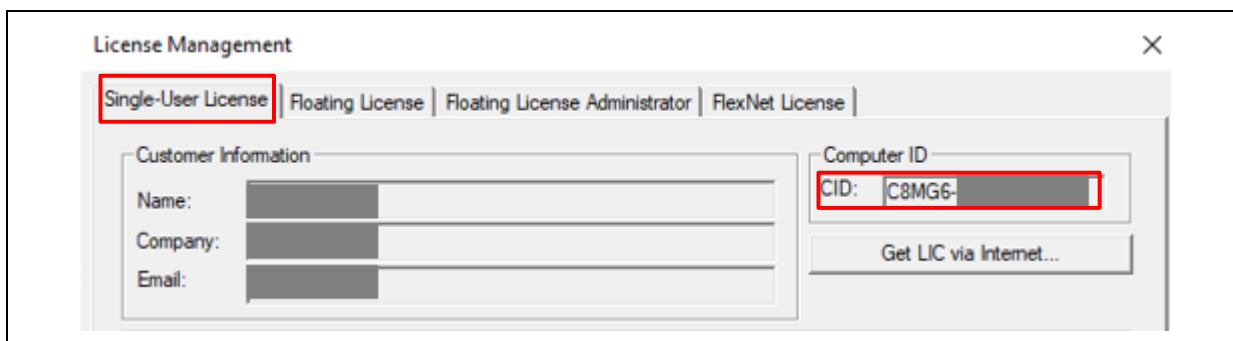


Figure 3-3 Get CID

- Go to <https://www.nuvoton.com/tool-and-software/ide-and-compiler/get-keil-mdk-lic/> , fill in CID and personal information..

Figure 3-4 Fill in CID

- Get License ID Code from user's Email.

Figure 3-5 Get License ID Code

- Open License Management, select “Single-User License” tab, and fill in the License ID Code (LIC) of the dialog License Management.

Figure 3-6 Set License ID Code

- Click “Add LIC” button.

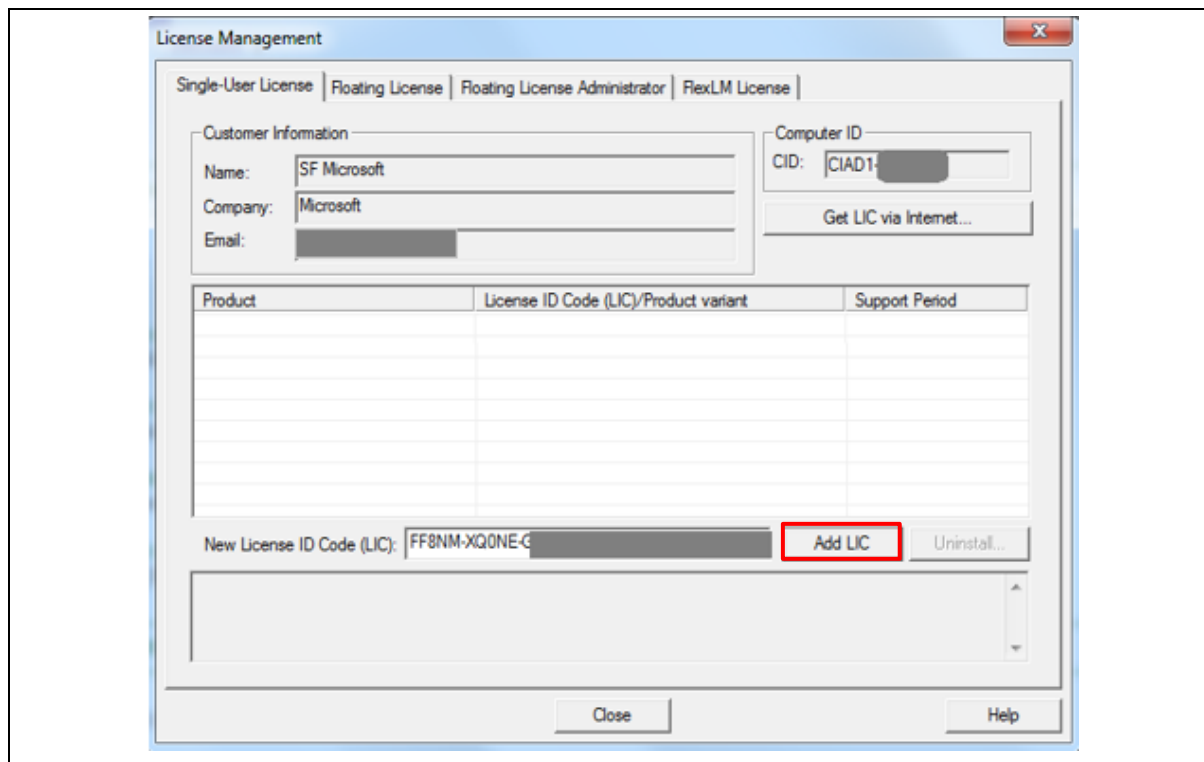


Figure 3-7 Add License ID Code

- Finally, the license is active and successful message is shown.

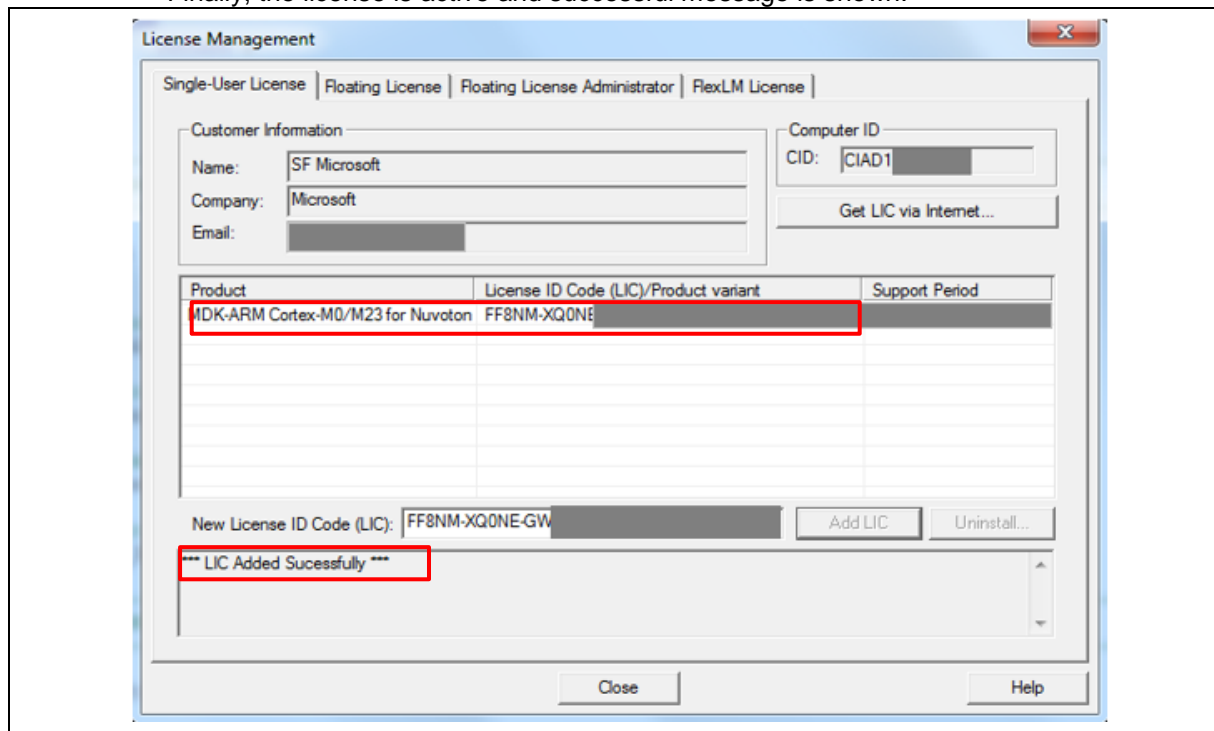


Figure 3-8 License is Active

User can go to <https://www.nuvoton.com/tool-and-software/ide-and-compiler/index.html> to download IDE and Nu-Link Driver.

- Install Nu-Link KEIL/IAR driver:
To use Nu-Link ICE with M2351, please install the Nu-Link driver by double clicking the installer file.

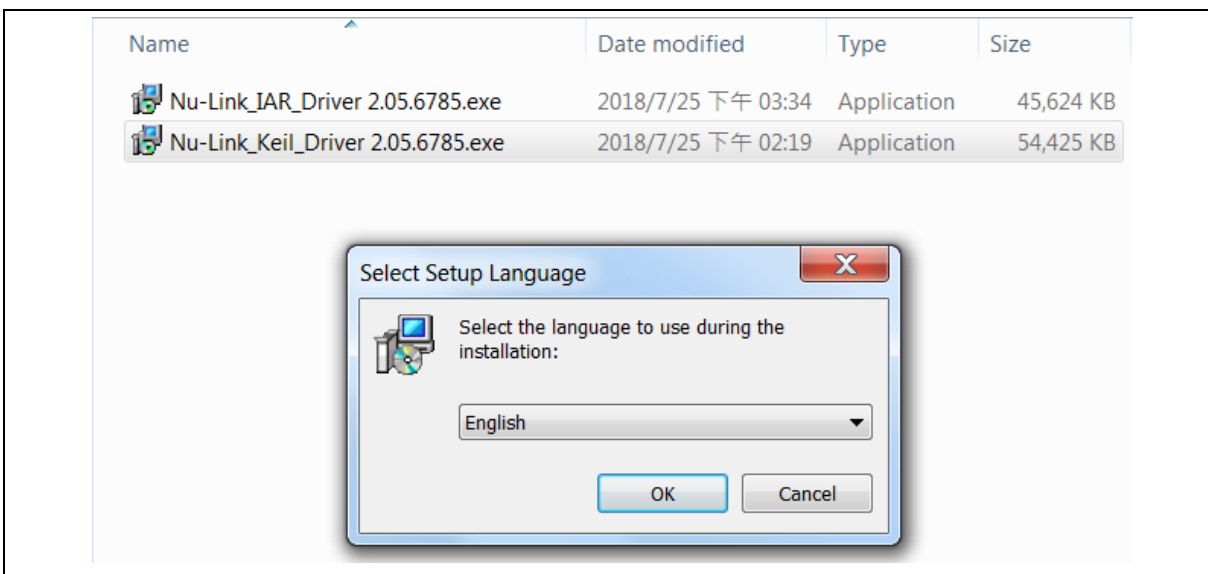


Figure 3-9 Nu-Link KEIL/IAR Driver Installer

- Install OpenOCD:
GNU Nuvoton Eclipse installer includes the installation of Eclipse and OpenOCD. To use Nu-Link ICE with M2351, please install default components by double clicking the installer file.

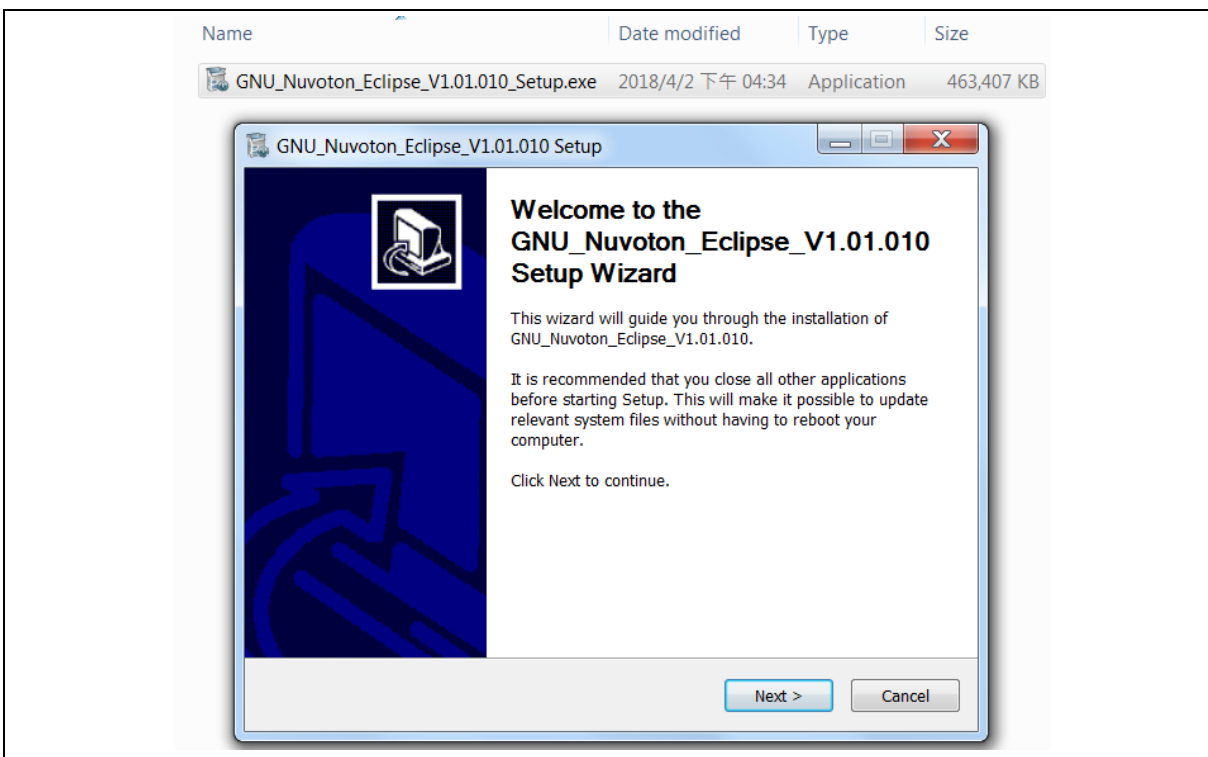


Figure 3-10 GNU Nuvoton Eclipse Installer

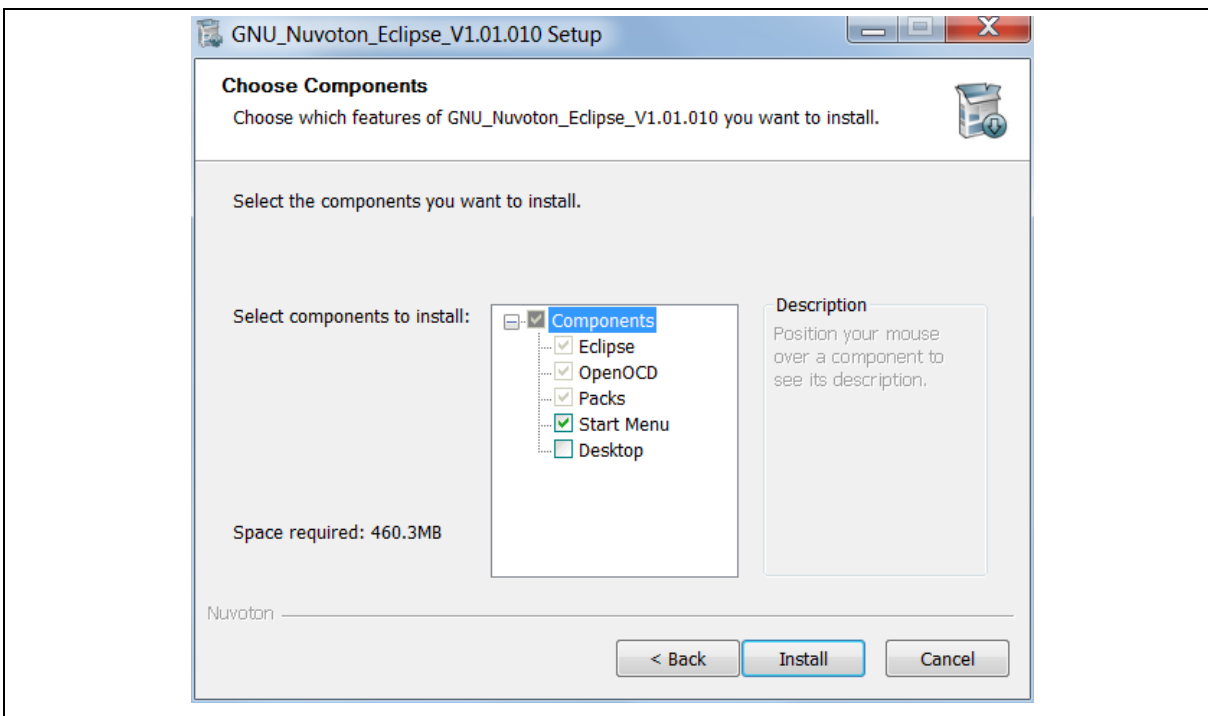


Figure 3-11 Default Components

- Install NuMicro ICP Programming Tool:
To use tool functions, please install the ICP Programming Tool by double clicking the installer file.

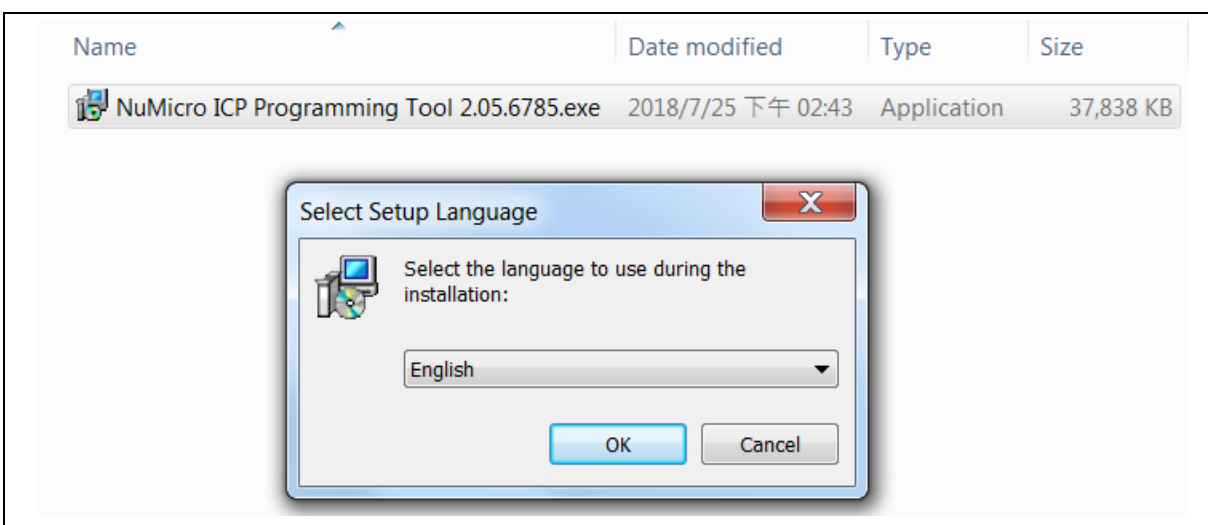


Figure 3-12 NuMicro ICP Programming Tool Installer

- Install M2351 KEIL Software Pack:

In KEIL MDK, It is necessary to update Nuvoton KEIL Software Pack to support M2351. In uVision5 IDE environment, click the **"Pack Installer"** icon to open the pack installer.

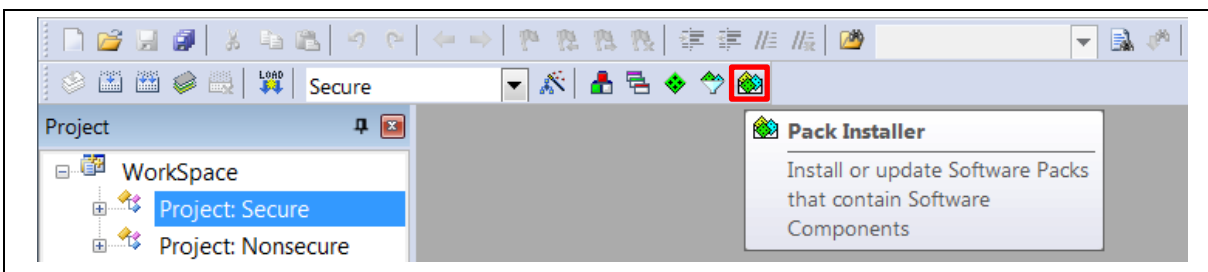
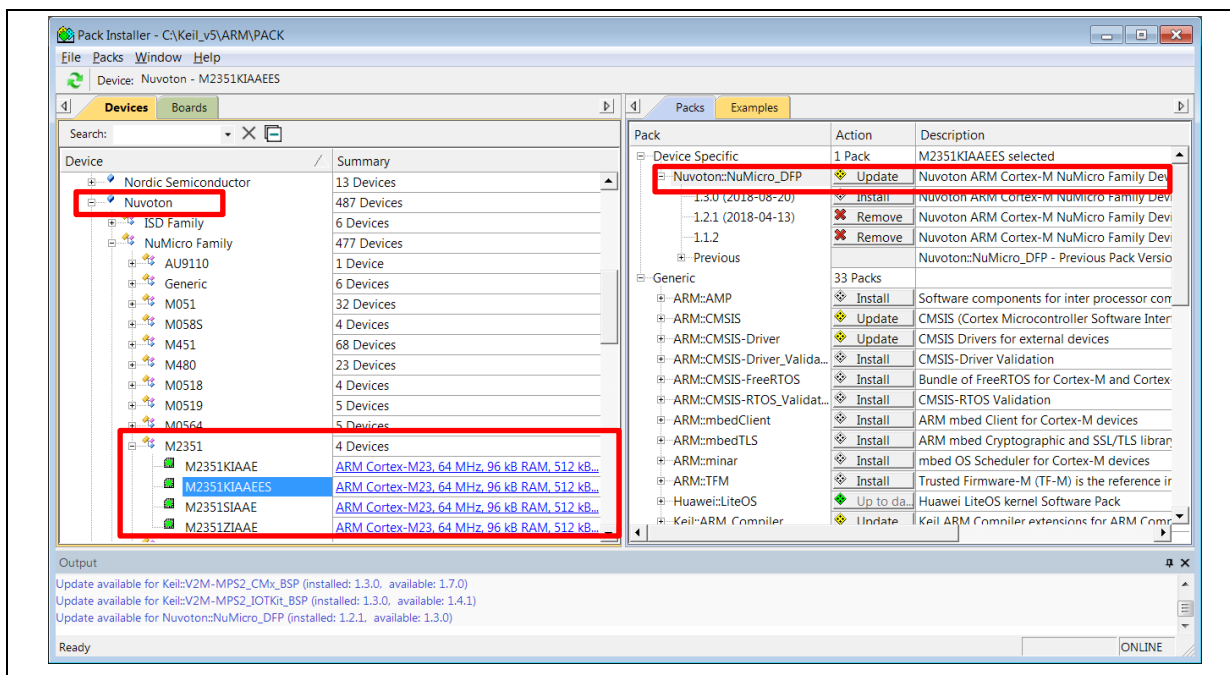


Figure 3-13 Pack Installer

Select "Devices" tab and click "Nuvoton -> M2351", then "Nuvoton:NuMicro_DFP" will be shown on Packs. Please install latest version by click "Install" or "Update" button.



To install software pack offline, user can open “Pack Installer”.

Then, use “**File -> Import...**” to install Nuvoton KEIL software pack.

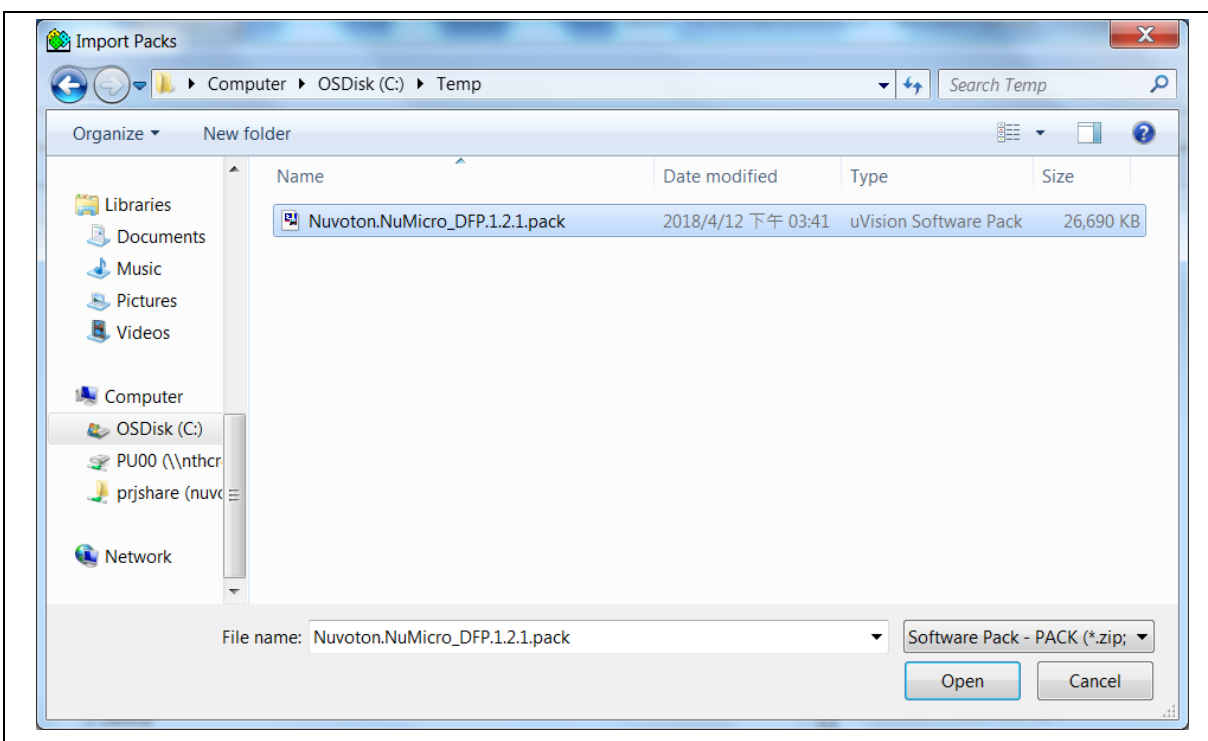


Figure 3-14 M2351 Software Pack File

4 BLINKY SAMPLE CODE

The Blinky sample code is a simple code to toggle LED on/off around the NuMaker-M2351 board.

The project file is located at:

`bsp\SampleCode\NuMaker\Blinky\Keil\Blinky.uvprojx` (For KEIL MDK)

or

`bsp\SampleCode\NuMaker\Blinky\IAR\Blinky.eww` (For IAR EWARM)

or

`bsp\SampleCode\NuMaker\Blinky\GCC` (For GNU Nuvoton Eclipse)

- Connect the Nu-Link ICE on the NuMaker-M2351 board to PC with USB

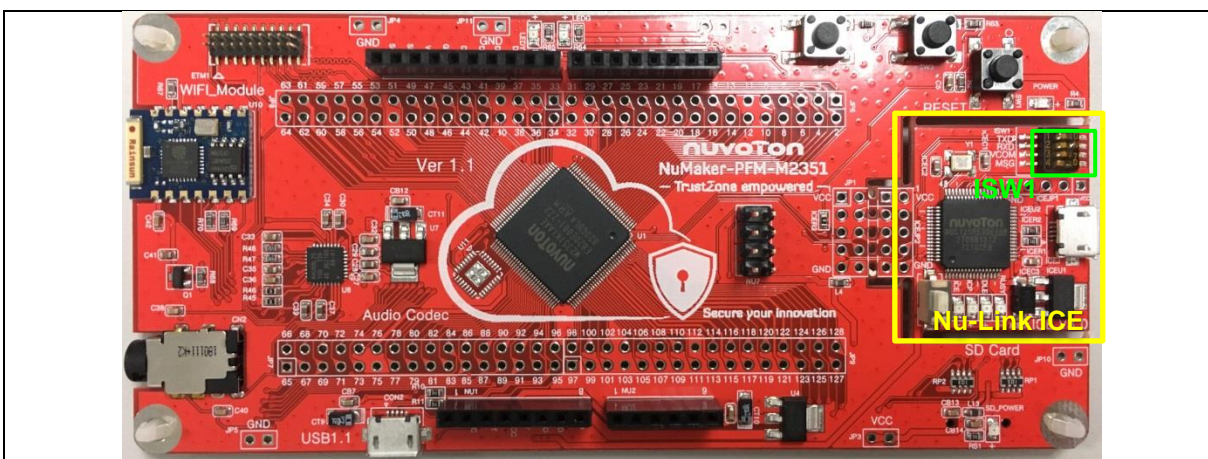


Figure 4-1 NuMaker-M2351 Board

The Nu-Link ICE has a Virtual COM port function for debug messages. After connecting Nu-Link, user can find VCOM on hardware manager in Windows PC.

Note1:

Nu-Link driver (KEIL or IAR) should be installed first before using the VCOM.

Note2:

The ISW1 needs to be set as below to enable VCOM function of Nu-Link ICE.

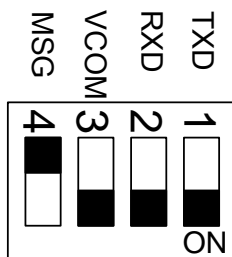


Figure 4-2

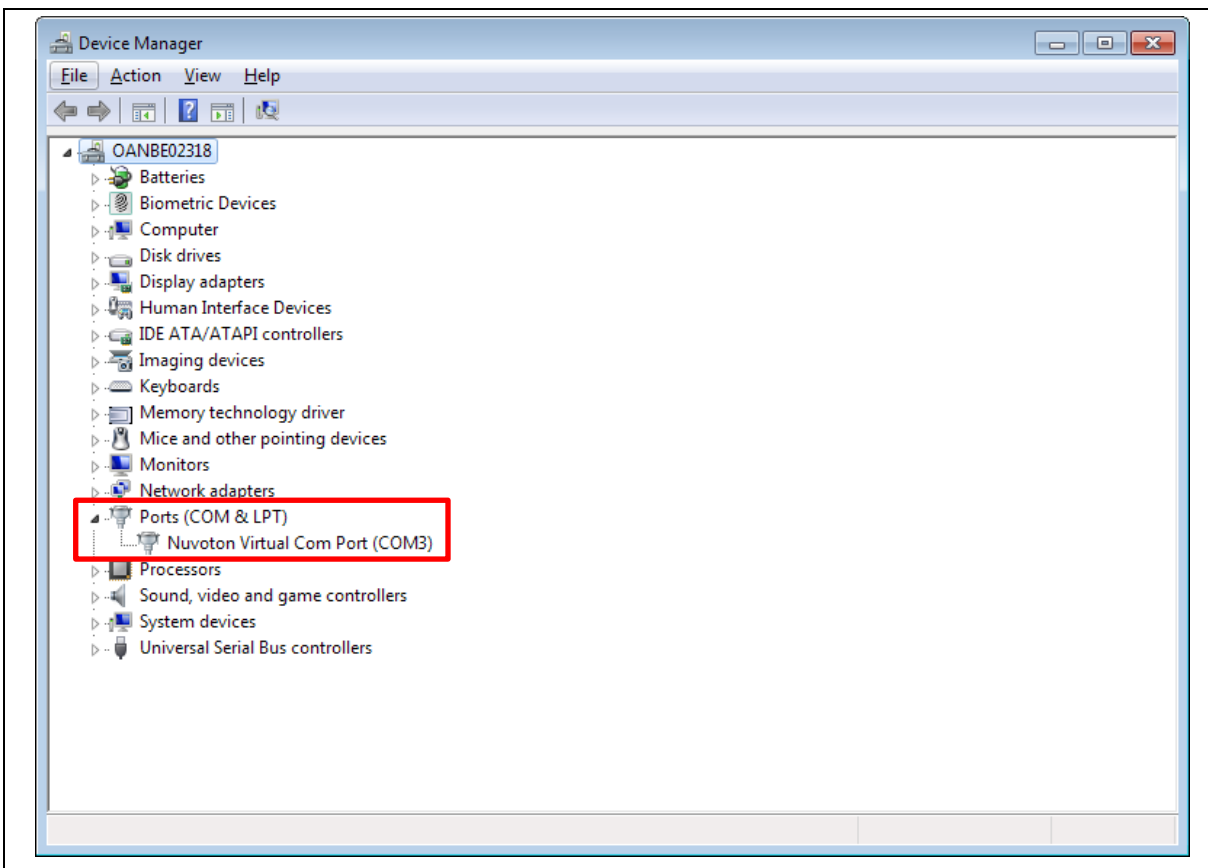


Figure 4-3 Nuvoton Virtual COM Port

A terminal tool can be used to open the Virtual COM port to monitor the M2351 debug message.

- Reset to factory default state:
User can use full chip erase function to reset the NuMaker-M2351 board to factory default state by ICP Programming Tool by the following steps:
 1. Double click the “**NuMicro ICP Programming Tool.exe**” to run ICP Programming Tool.
 2. Select target chip as “**M2351 Series**” and then click “**Continue >>**”.
 3. Click “**Connect**” to wait for M2351 being connected with Nu-Link.
 4. After chip is connected to ICP Programming Tool, click “**Tool -> Erase Whole Target Chip**”, and then click “**OK**” twice.
 5. When full chip erase has done, tool will read flash data again. Click “**Disconnect**” to let M2351 disconnect from ICP Programming Tool.

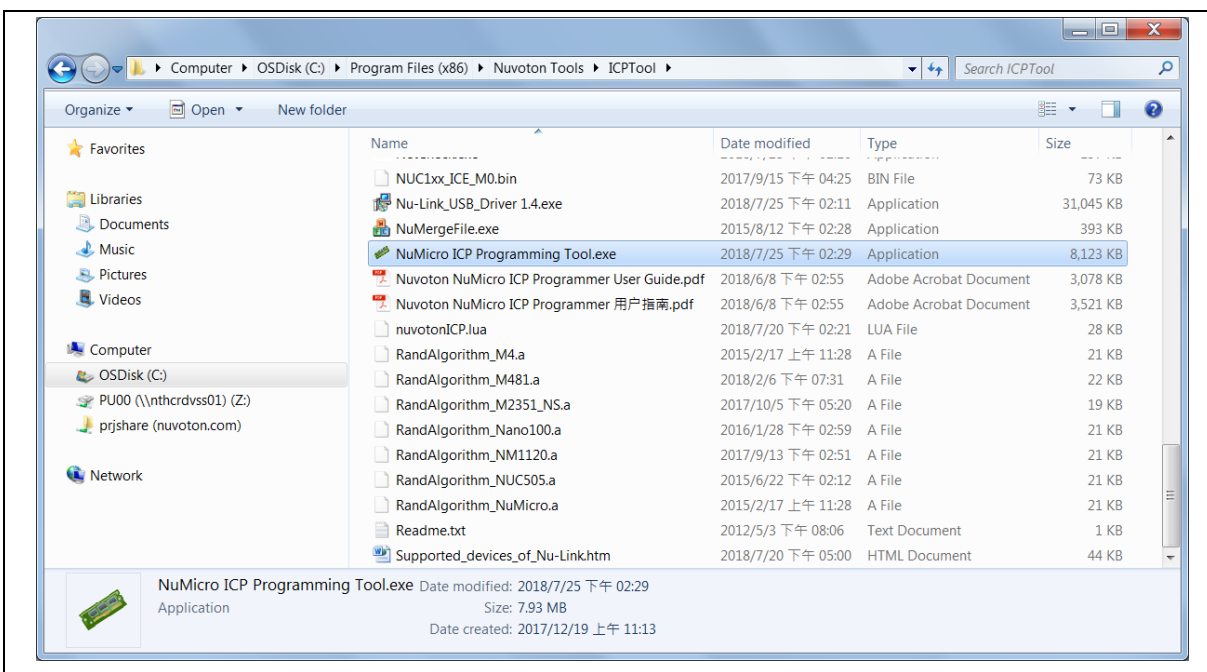


Figure 4-4 Do Full Chip Erase Step 1

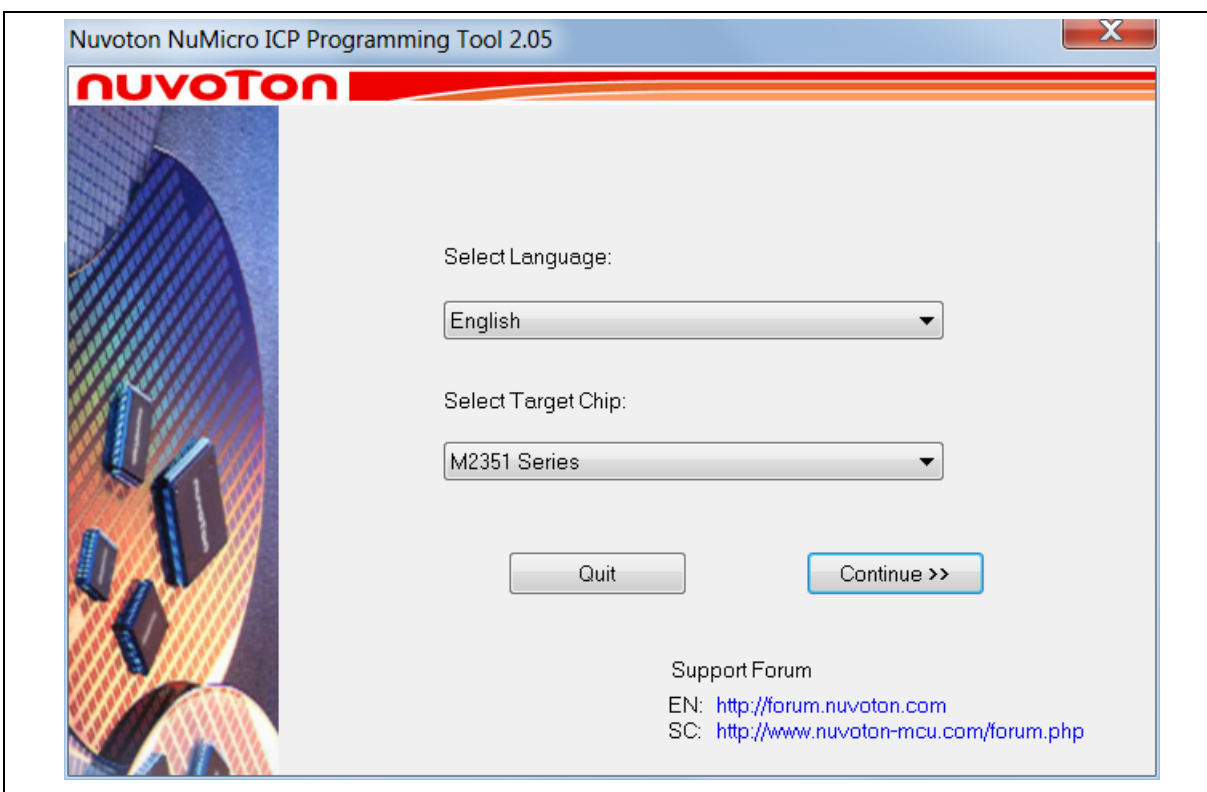


Figure 4-5 Do Full Chip Erase Step 2

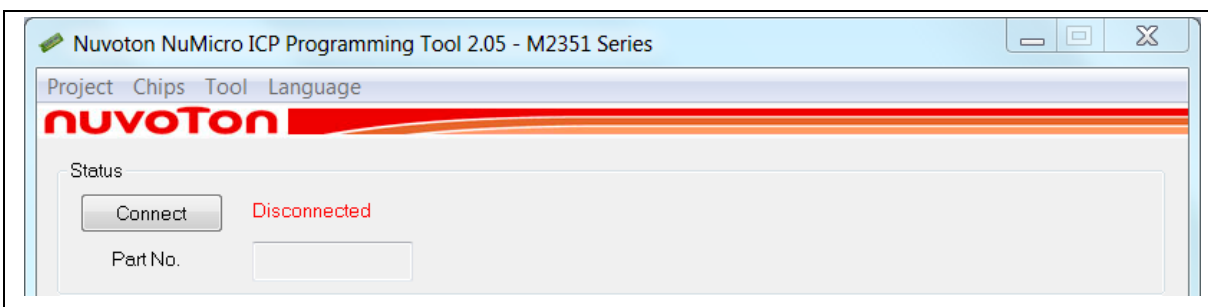


Figure 4-6.1 Do Full Chip Erase Step 3

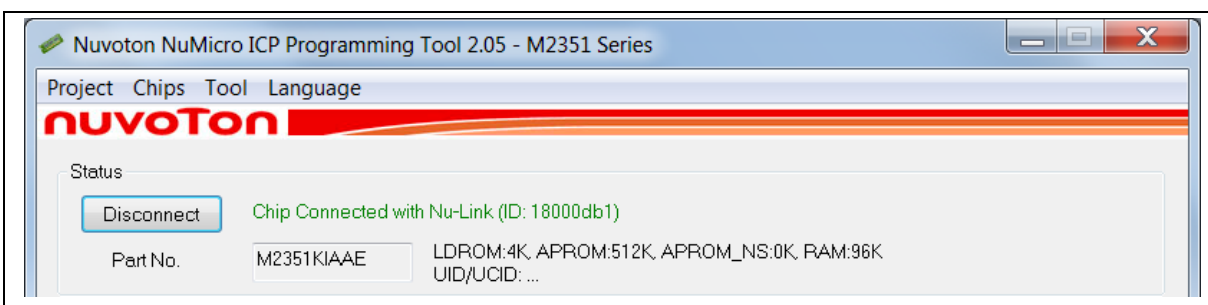


Figure 4-7.2 Do Full Chip Erase Step 3

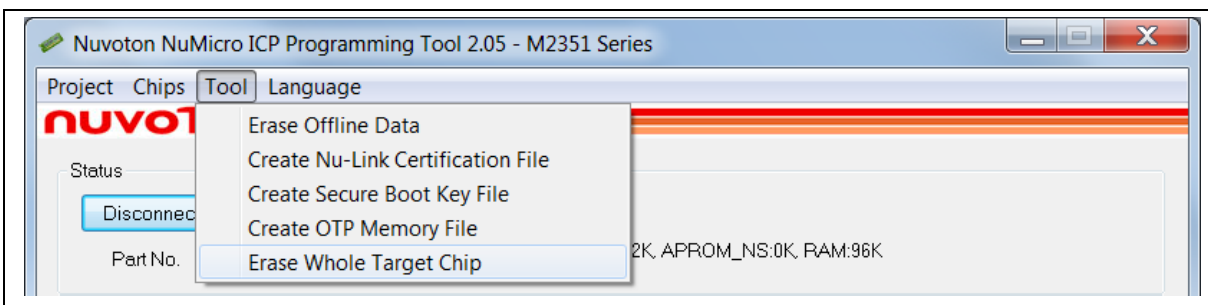


Figure 4-8 Do Full Chip Erase Step 4

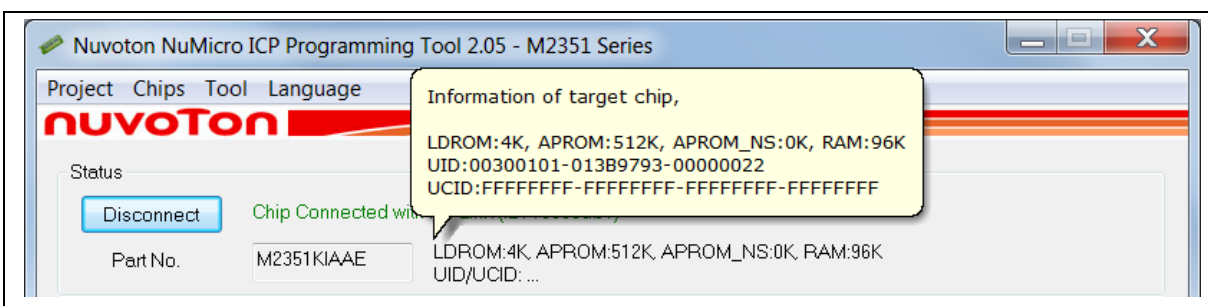


Figure 4-9.1 Do Full Chip Erase Step 5

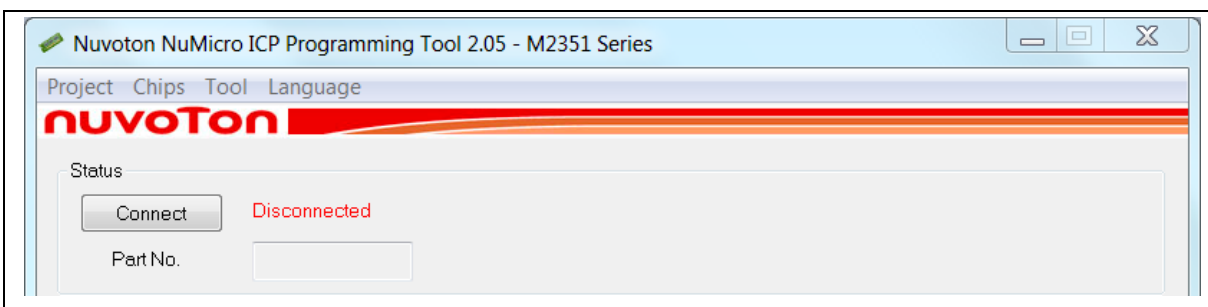


Figure 4-10.2 Do Full Chip Erase Step 5

- Open the sample code:
User can open the sample code with KEIL uVision5 by double clicking the “**Blinky.uvprojx**” file.

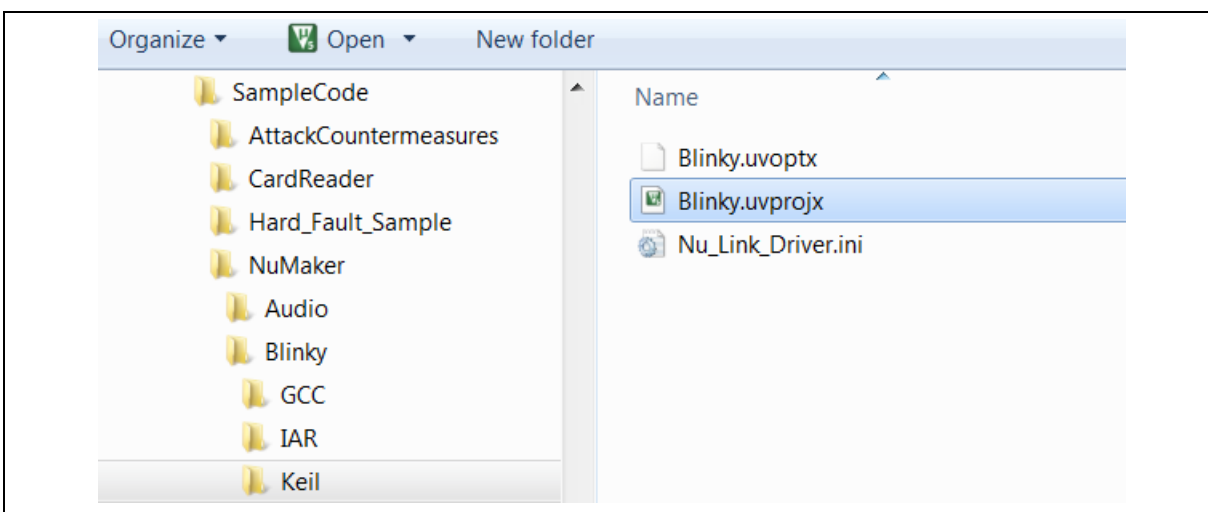


Figure 4-11 Blinky KEIL Project File

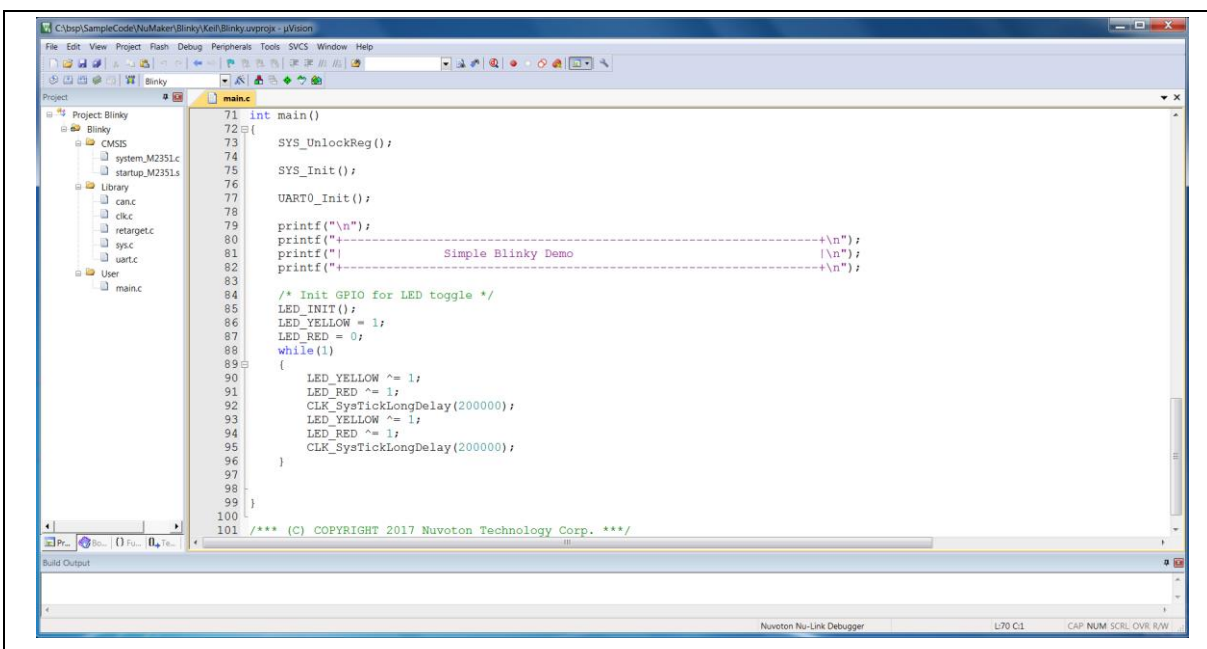


Figure 4-12 Blinky Sample Code KEIL Project Screenshot

If IAR EWARM is used, user can open the project by double clicking the **"Blinky.eww"** file.

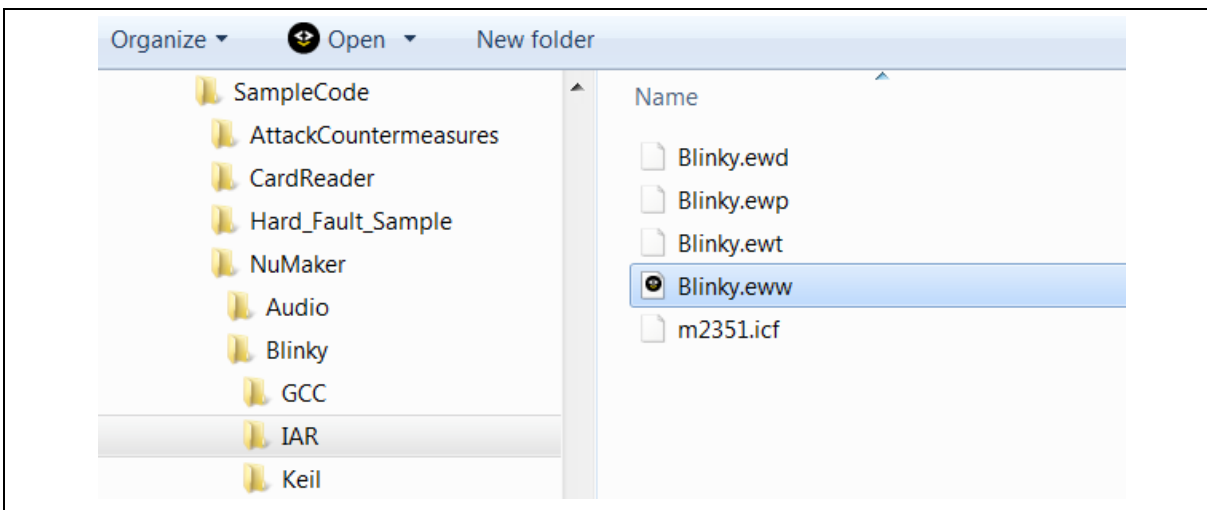


Figure 4-13 Blinky IAR Project File

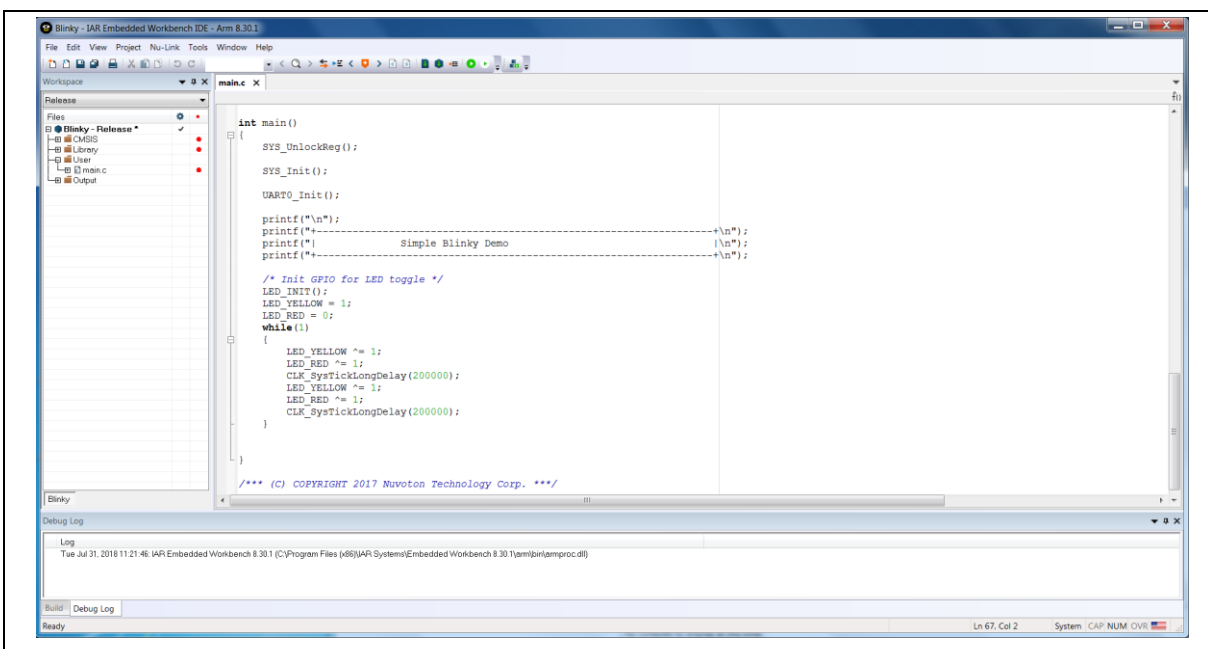


Figure 4-14 Blinky Sample Code IAR Project Screenshot

If GNU Nuvoton Eclipse is used, user can open the project by the following steps:

1. Double click the “**eclipse.exe**” to run GNU Nuvoton Eclipse.
2. “**Browse...**” a workspace directory and then click “**OK**”.
3. Click “**File -> Import...**”, then select “**General -> Existing Project into Workspace**” and click “**Next**”.
4. “**Browse...**” the Blinky GCC project directory and click “**Finish**”.

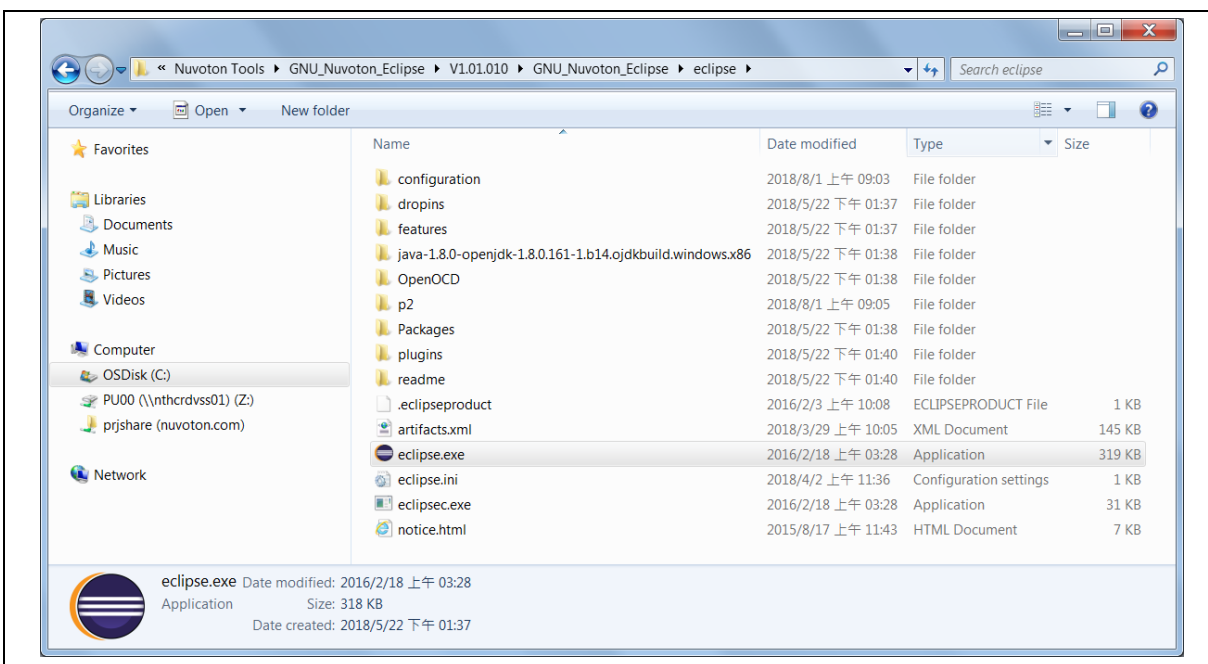


Figure 4-15 Open Blinky GCC Project Step 1

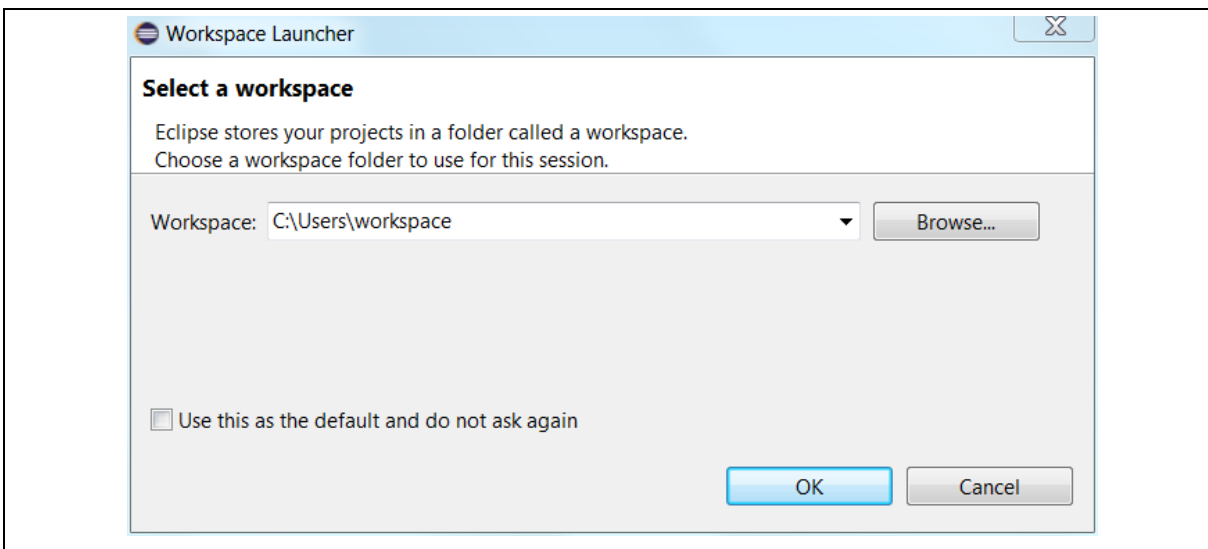


Figure 4-16 Open Blinky GCC Project Step 2

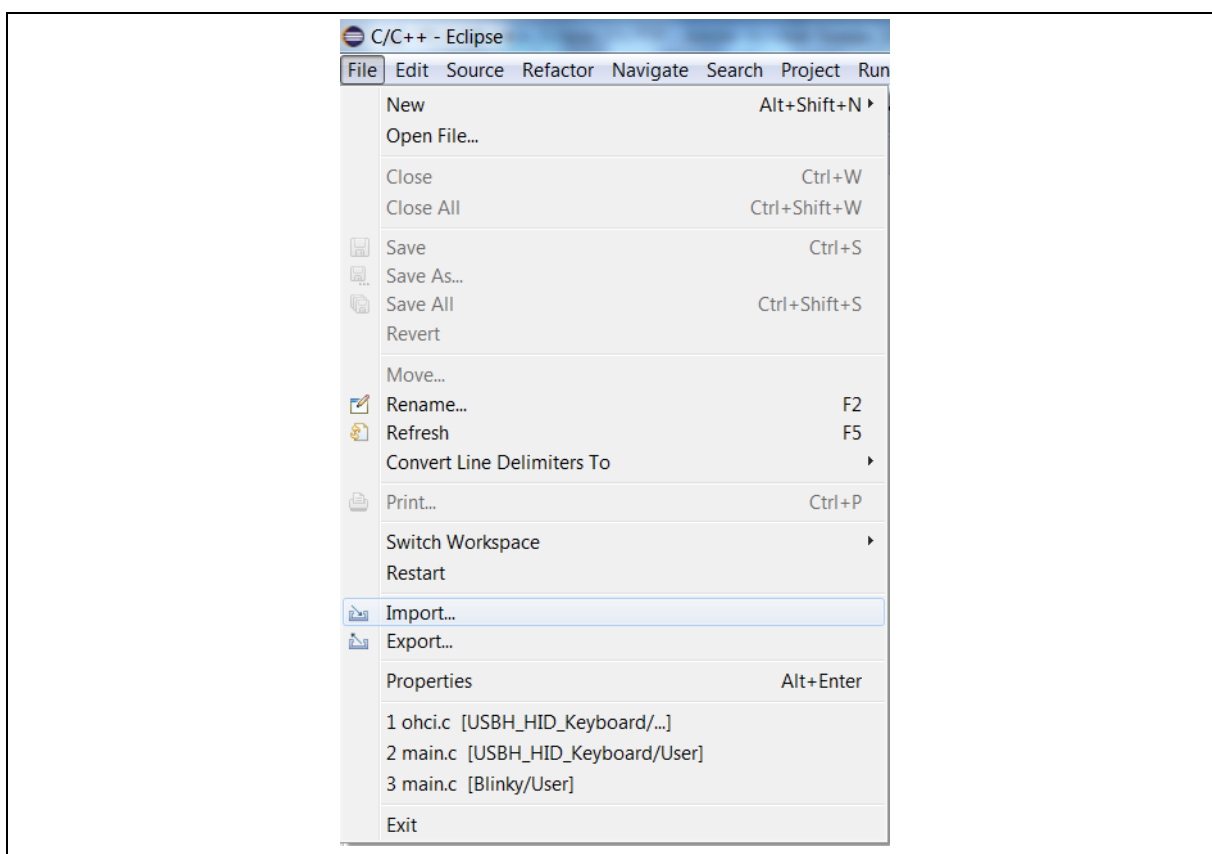


Figure 4-17.1 Open Blinky GCC Project Step 3

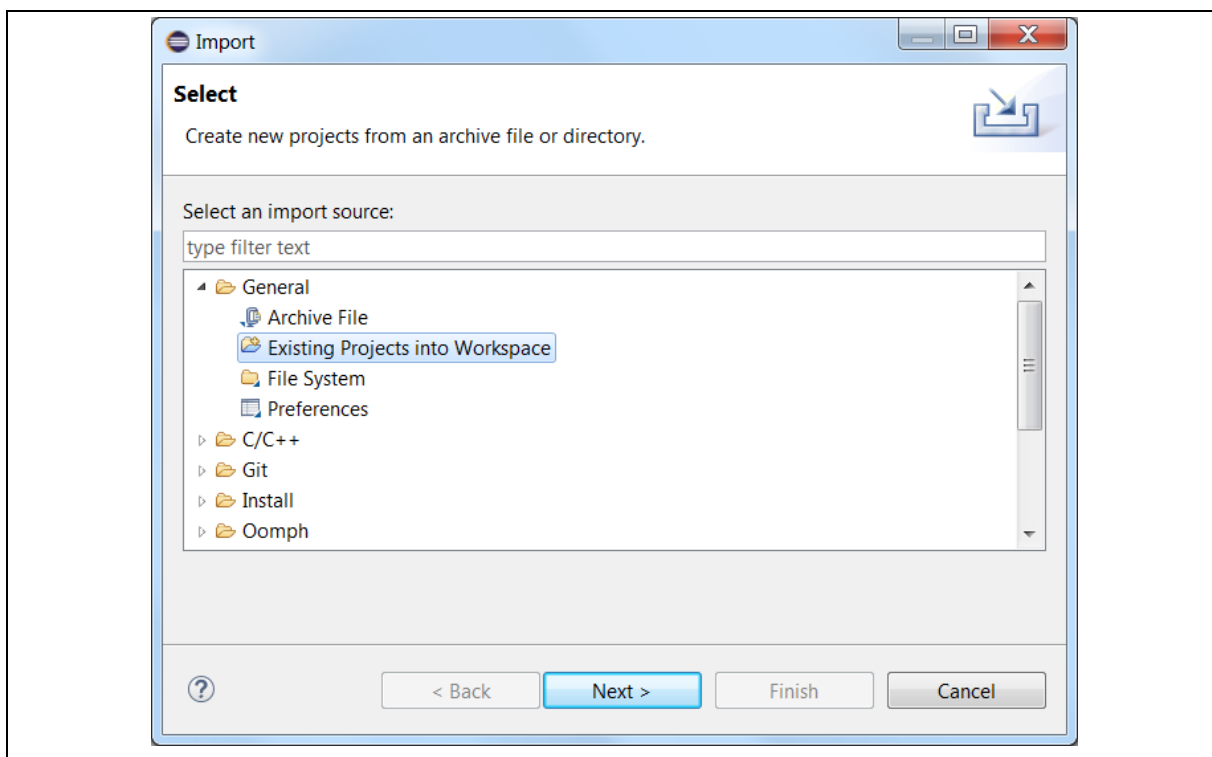


Figure 4-18.2 Open Blinky GCC Project Step 3

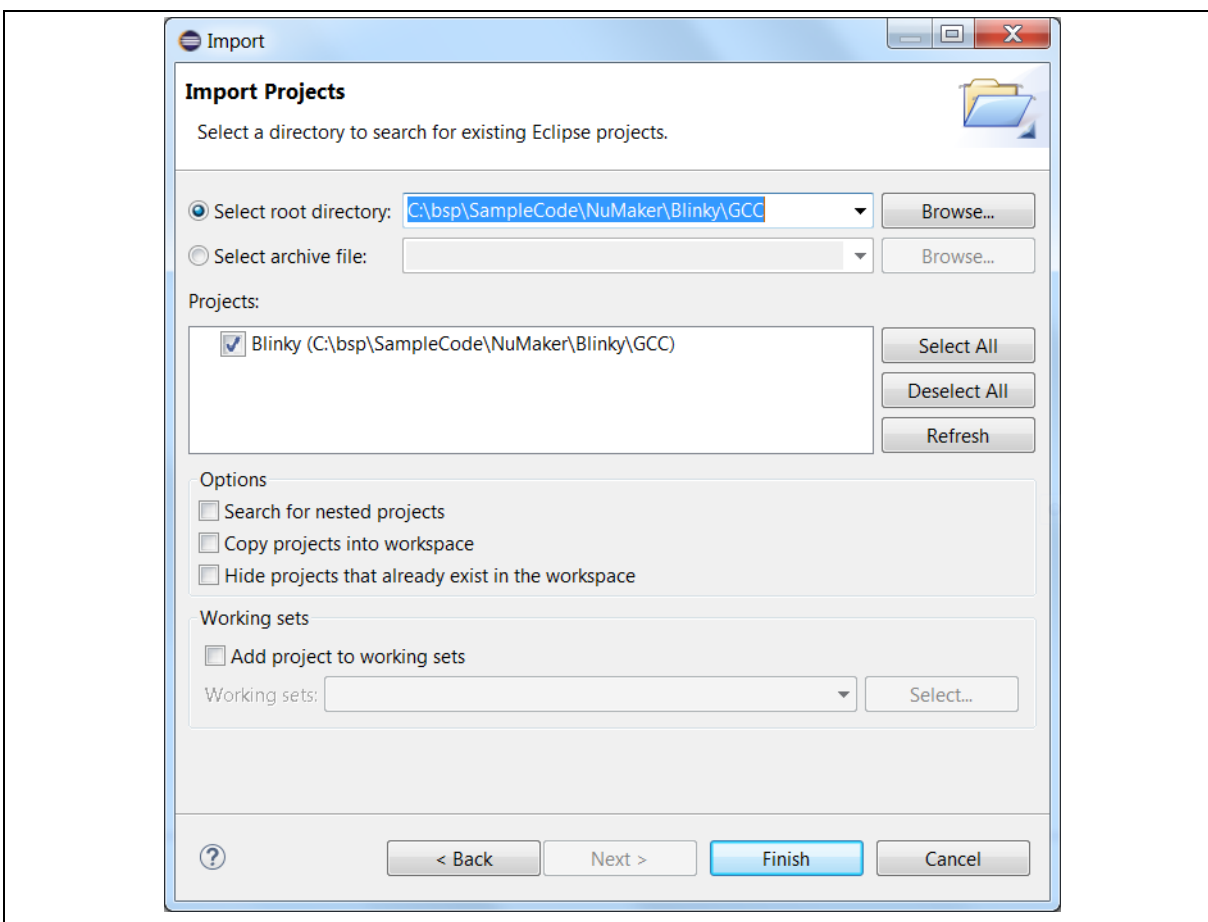


Figure 4-19 Open Blinky GCC Project Step 4

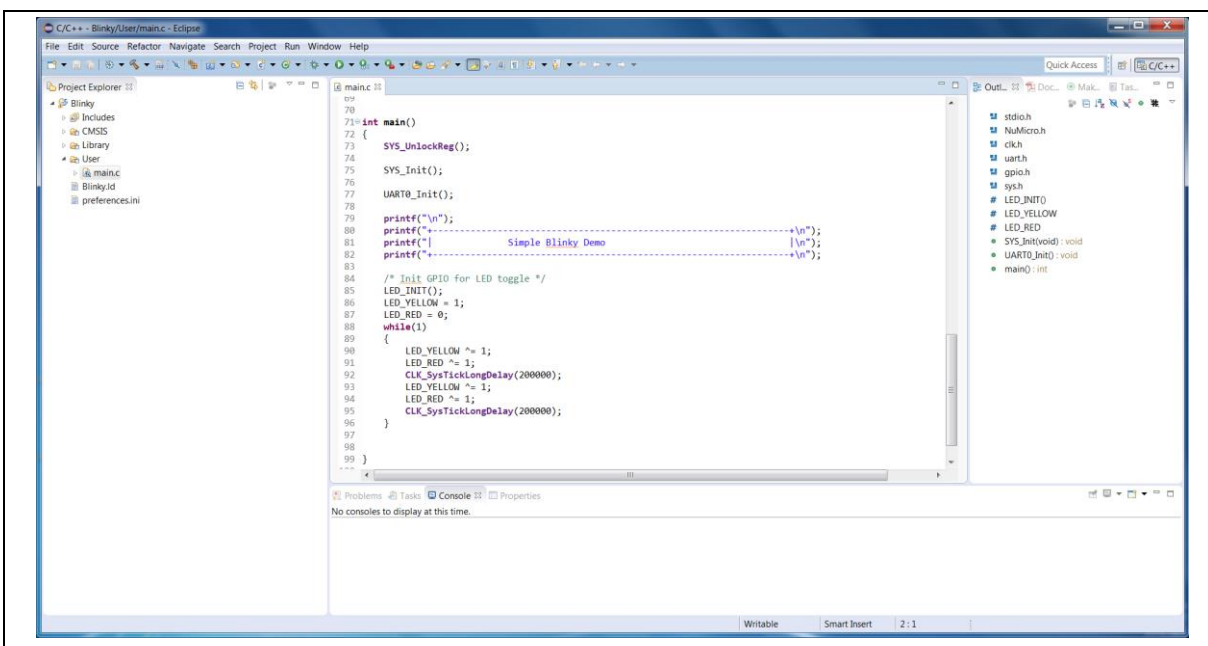


Figure 4-20 Blinky Sample Code GCC Project Screenshot

- Build the sample code:
User can click the “**Rebuild**” icon to build the sample code in KEIL MDK.

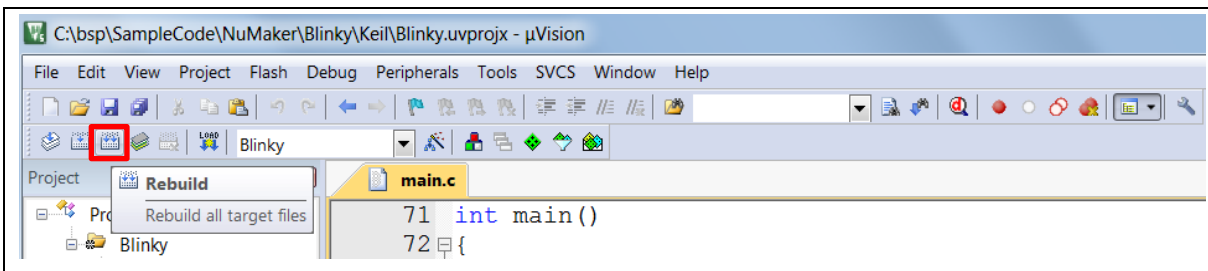


Figure 4-21 Rebuild with KEIL MDK

Or click “**Project -> Rebuild All**” in IAR EWARM.

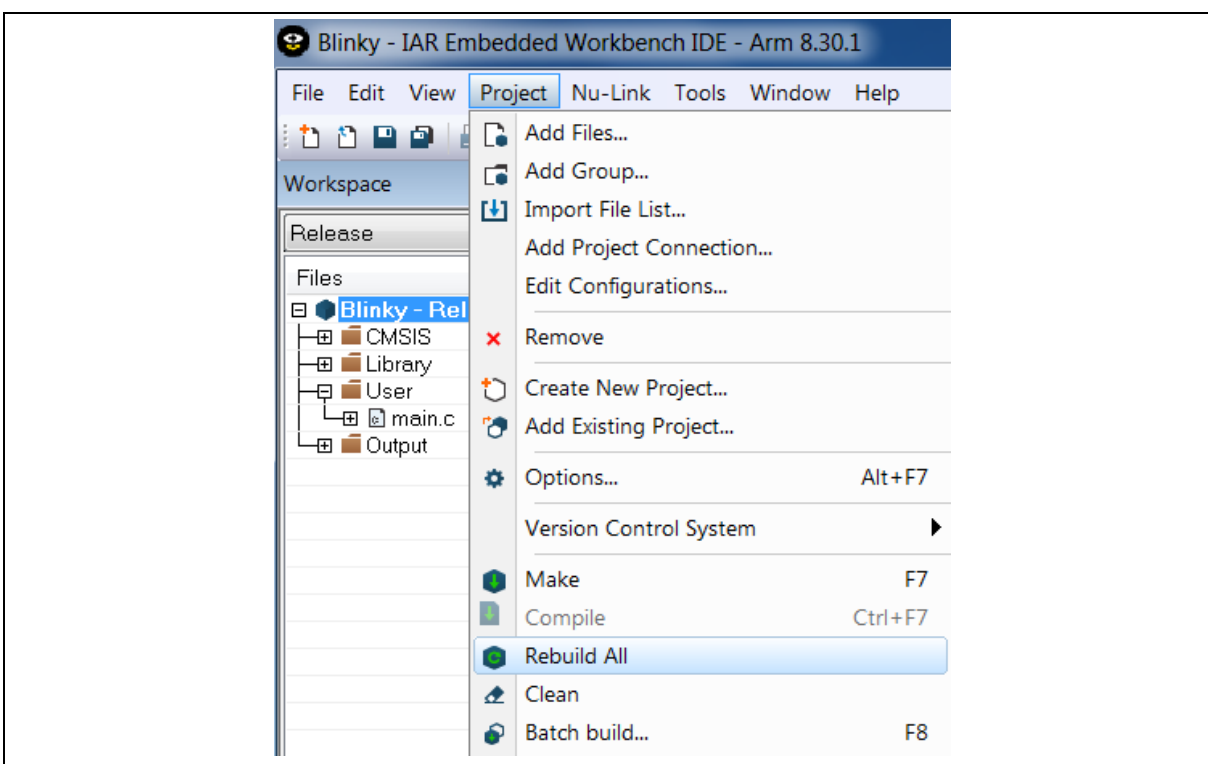


Figure 4-22 Rebuild with IAR EWARM

Or click “**Project -> Build Project**” in GNU Nuvoton Eclipse.

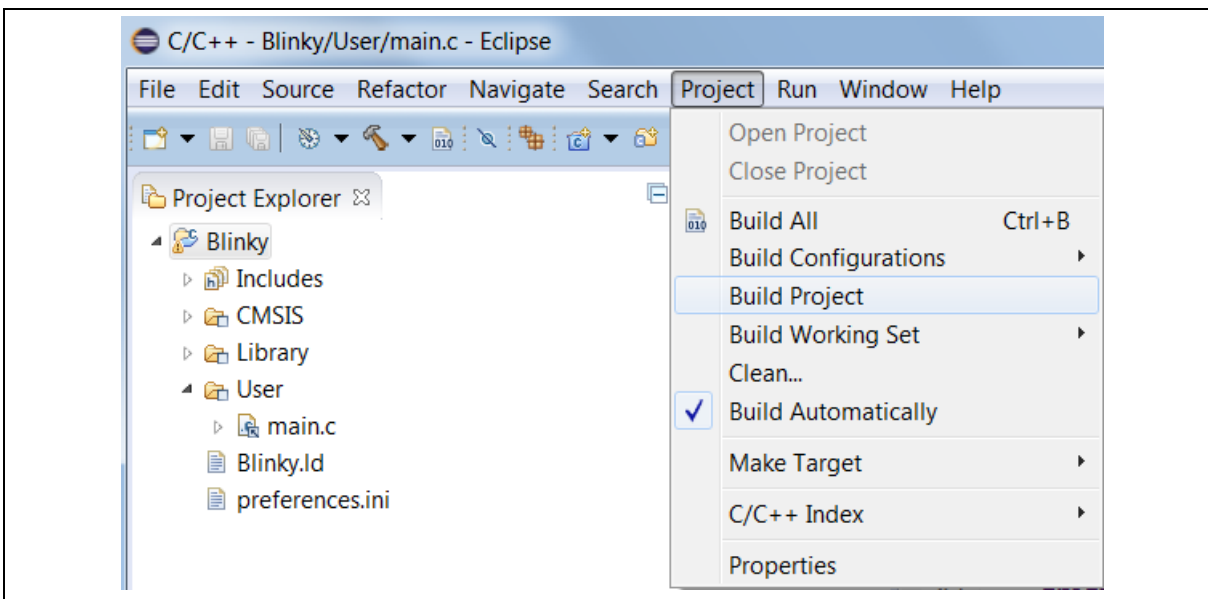


Figure 4-23 Rebuild with GNU Nuvoton Eclipse

- Download firmware to M2351:
User can click the “**Download**” icon to download the code to M2351 in KEIL MDK.

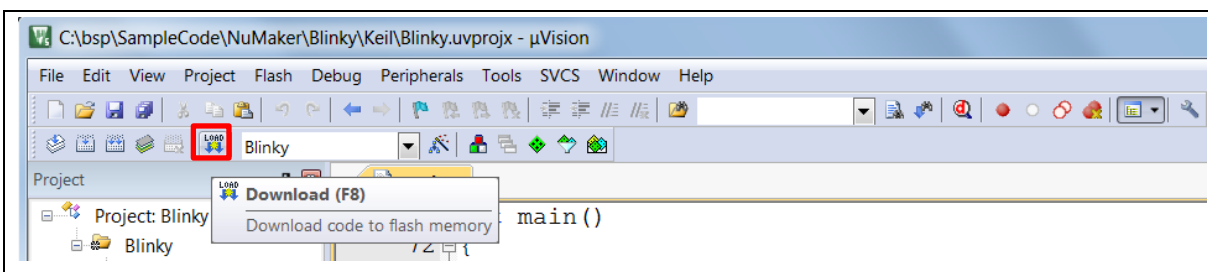


Figure 4-24 Firmware Download with KEIL

Or click “**Project -> Download -> Download active application**” to download the code to M2351 in IAR EWARM.

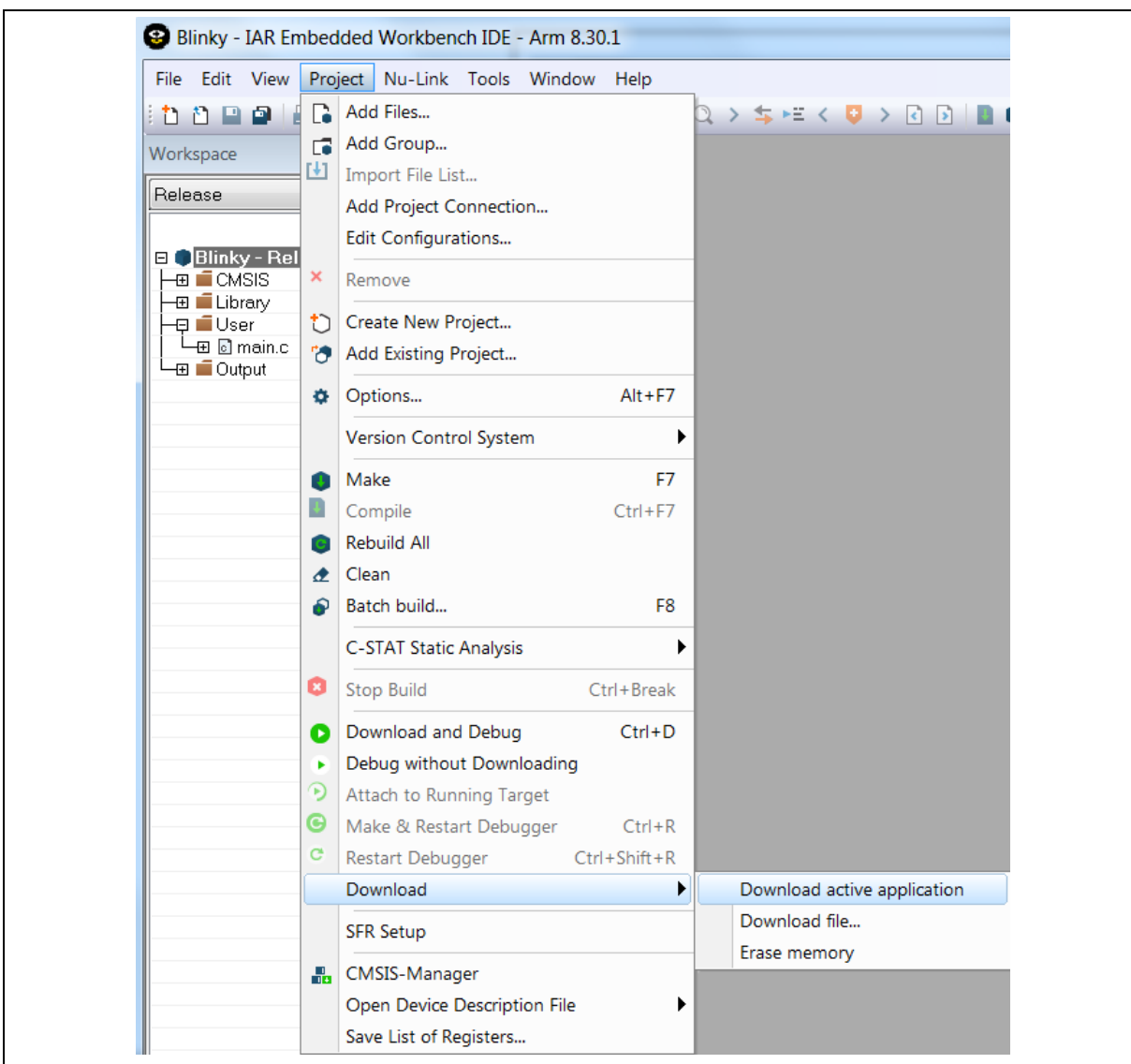


Figure 4-25 Firmware Download with IAR

Or click “**Run -> Debug Configurations...**” to open the debug configuration dialog in GNU Nuvoton Eclipse.

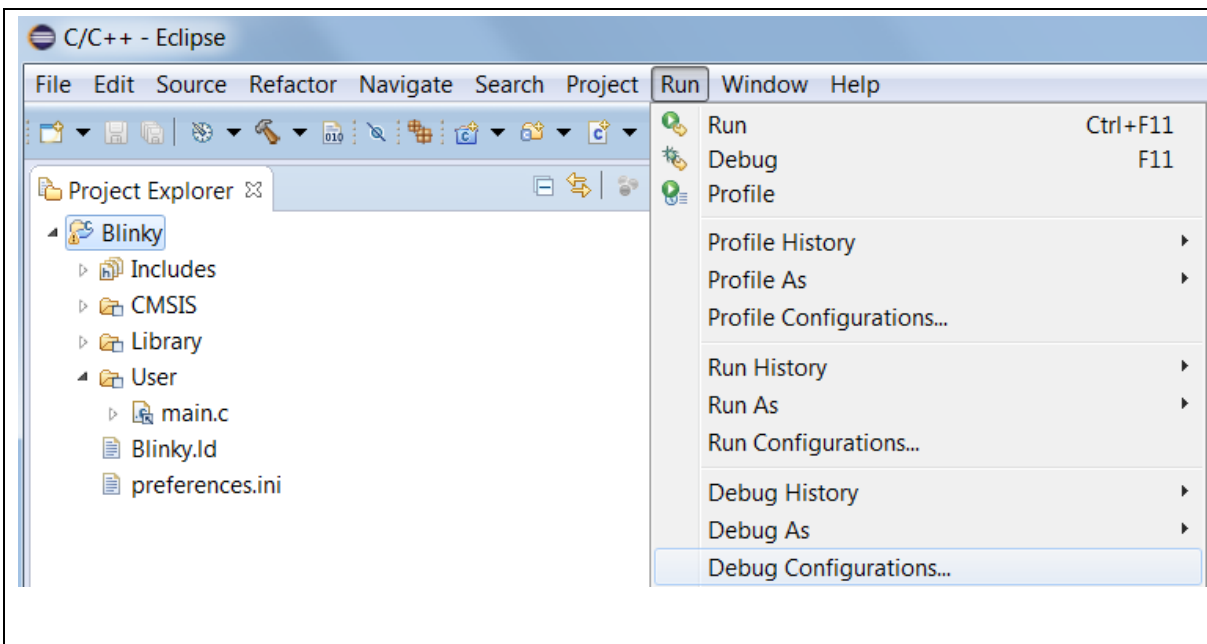


Figure 4-26.1 Firmware Download with GCC

Double click “**GDB Nuvoton Nu-Link Debugging**” to generate Nuvoton Nu-Link debug configuration “**Blinky Release**”, then click “**Debug**” to download the code to M2351.

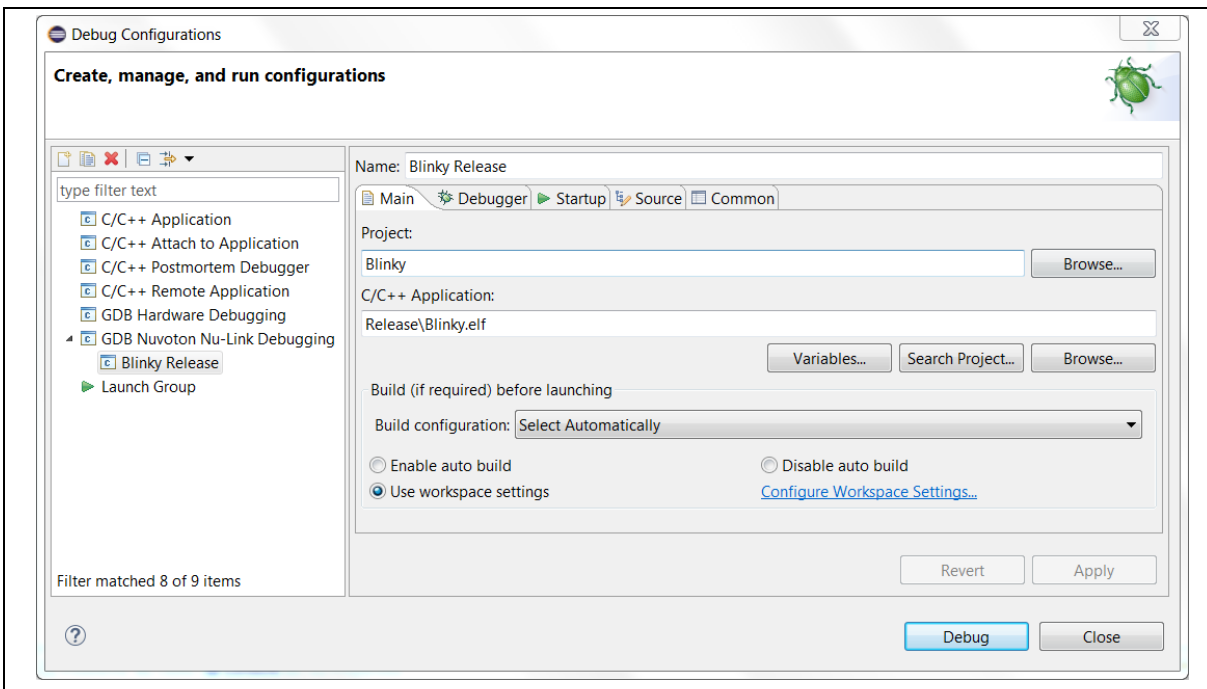


Figure 4-27.2 Firmware Download with GCC

- Press reset on the board to execute the code
After downloading the code, user can press reset to execute the firmware. The IO_LED on the board will blink and a sample code message will be shown on the debug port.

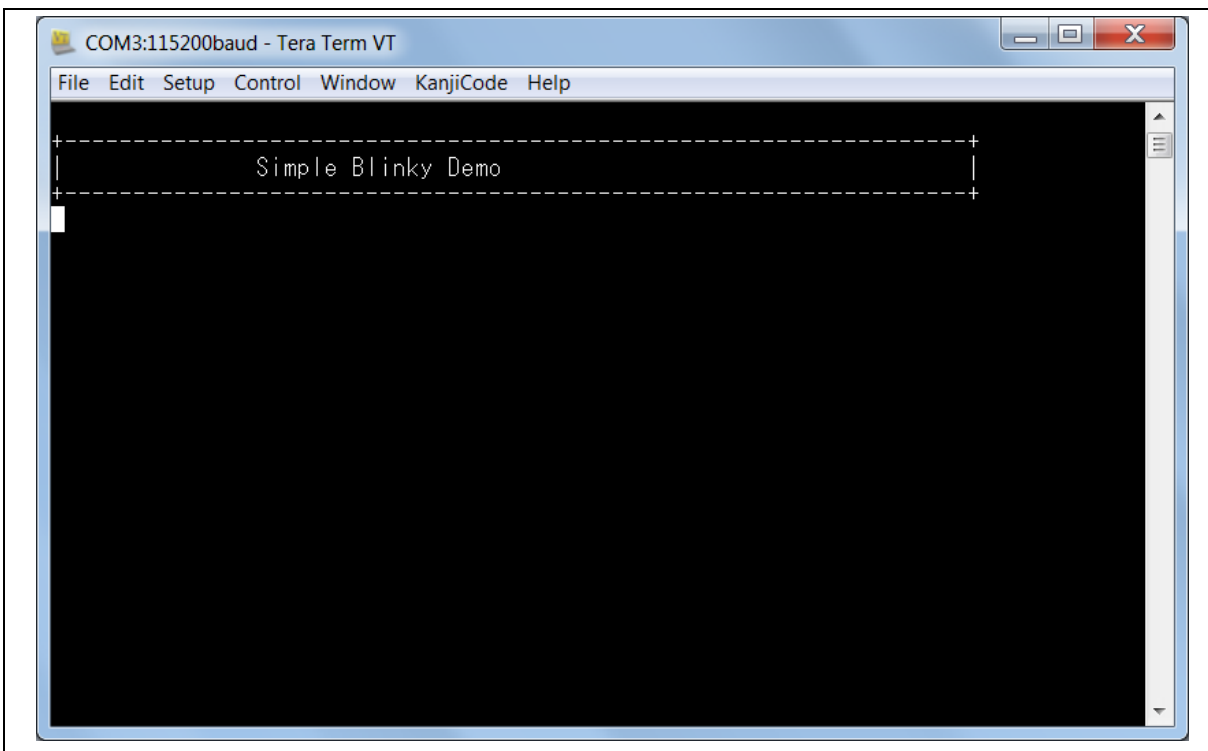


Figure 4-28 Blinky Sample Code Screenshot

- NuMaker-M2351 board can be set as ICP or Mass-Storage by setting MSG of ISW1. If MSG is set to off, the NuMaker-M2351 is set as ICP that user can connect the Nu-Link ICE to PC, download code, and debug. Otherwise, if MSG is set to on, the NuMaker-M2351 is set as Mass-Storage.

5 REVISION HISTORY

Date	Revision	Description
2018.08.31	1.00	1. Initially issued.
2018.10.29	1.01	1. Add licensing keil MDK descriptions. 2. Add ISW1 description.
2022.12.07	1.02	1. Updated method of Keil free license

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