

SN32F400 Series

QUICK START

SN32F407
SN32F405
SN32F403

SONiX 32-Bit Cortex-M0 Micro-Controller

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AMENDENT HISTORY

Version	Date	Description
1.0	2024/03/27	1. First version.
1.1	2024/12/05	1. Add introduction of 3.4 Migrate ARM Compiler 5 to ARM Compiler 6
1.2	2025/03/07	1. Update “Target” and “C/C++ (AC6)” images in Section 3.4.1
1.3	2025/03/31	1. Update Target ROM size of Keil Option.

Table of Content

AMENDMENT HISTORY.....	2
1 OVERVIEW.....	4
1.1 SN32F400 QUICK START DEVELOPMENT PACKAGE.....	4
1.2 KEIL MDK-ARM.....	4
2 SETUP	6
2.1 ICE.....	6
2.2 SN32F400 STARTER-KIT BOARD	7
2.3 KEIL MDK-ARM.....	8
3 DEVELOP	9
3.1 BUILD A NEW PROJECT.....	9
3.2 USE SONiX SAMPLE CODE	17
3.3 DEBUG.....	21
3.3.1 CMSIS-SVD (System View Debug).....	22
3.4 MIGRATE ARM COMPILER 5 TO ARM COMPILER 6.....	24
3.4.1 Target Options.....	24

1 OVERVIEW

The purpose of this document is to make the users be familiar with SONiX SN32F400 Quick Start Development Package and the settings of Keil MDK-ARM.

1.1 SN32F400 QUICK START DEVELOPMENT PACKAGE

SN32F400 Quick Start Development Package includes

H/W

1. SN32F400 Starter Kit Board
2. SN-LINK-V3

S/W

1. SN32F400 CMSIS Files
2. SN32F400 Flash Algorithm file
3. SN32F400 FW Library
4. SN32F400 Tool Installer

1.2 KEIL MDK-ARM

The MDK-ARM is a complete software development environment for Cortex™-M, Cortex-R4, ARM7™ and ARM9™ processor-based devices. MDK-ARM is specifically designed for microcontroller applications, it is easy to learn and use, yet powerful enough for the most demanding embedded applications.

- Complete support for Cortex-M, Cortex-R4, ARM7, and ARM9 devices
- Industry-leading ARM [C/C++ Compilation Toolchain](#)
- [µVision4](#) IDE, debugger, and simulation environment
- Keil [RTX](#) deterministic, small footprint real-time operating system (with source code)
- [TCP/IP Networking Suite](#) offers multiple protocols and various applications
- [USB Device](#) and [USB Host](#) stacks are provided with standard driver classes
- Complete [GUI Library](#) for embedded systems with graphical user interfaces
- [ULINKpro](#) enables on-the-fly analysis of running applications and records every executed Cortex-M instruction
- Complete [Code Coverage](#) information about your program's execution
- [Execution Profiler](#) and [Performance Analyzer](#) enable program optimization
- Numerous example projects help you quickly become familiar with MDK-ARM's powerful, built-in features
- [CMSIS](#) Cortex Microcontroller Software Interface Standard compliant

MDK-ARM is available in 4 editions: MDK-Lite, MDK-Basic, MDK-Standard, and MDK-Professional.

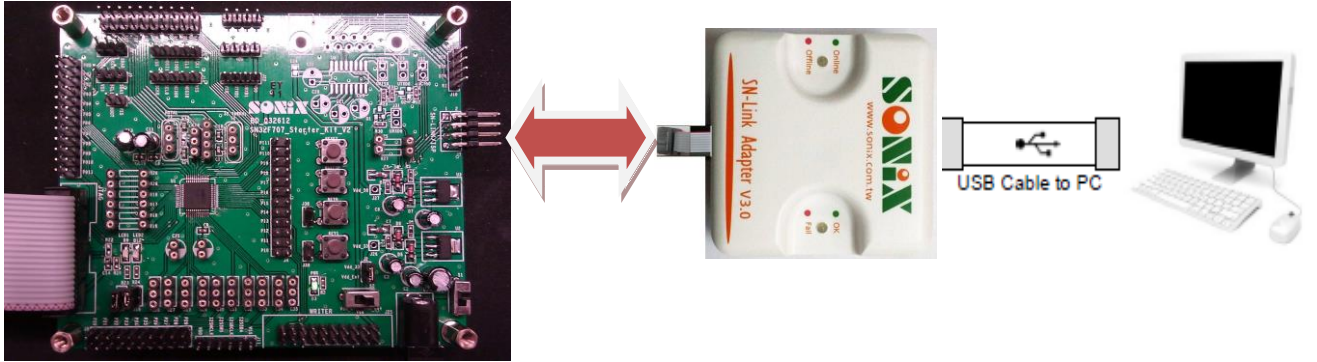
All editions provide a complete C/C++ development environment and MDK-Professional includes extensive middleware libraries. Refer to the [Product Selector](#) for more details.

For MDK Version 5 additional software components and support for microcontroller devices is provided by Software Packs. DFP (Device Family Pack) indicates that a Software Pack contains support for microcontroller devices.

*** Note:** 1. MDK-Lite (32KB) Edition is available for [download](#). It does not require a serial number or license key.
2. Please refer to [3.1 Build a New Project](#) step3 to download SONiX 32-bit M0 MCU DFP from Pack Installer of Keil MDK V5.X

Please link to <http://www.keil.com/arm/mdk.asp> to download and see more detail introduction.

2 SETUP



SONiX 32-bit Series Starter-kit

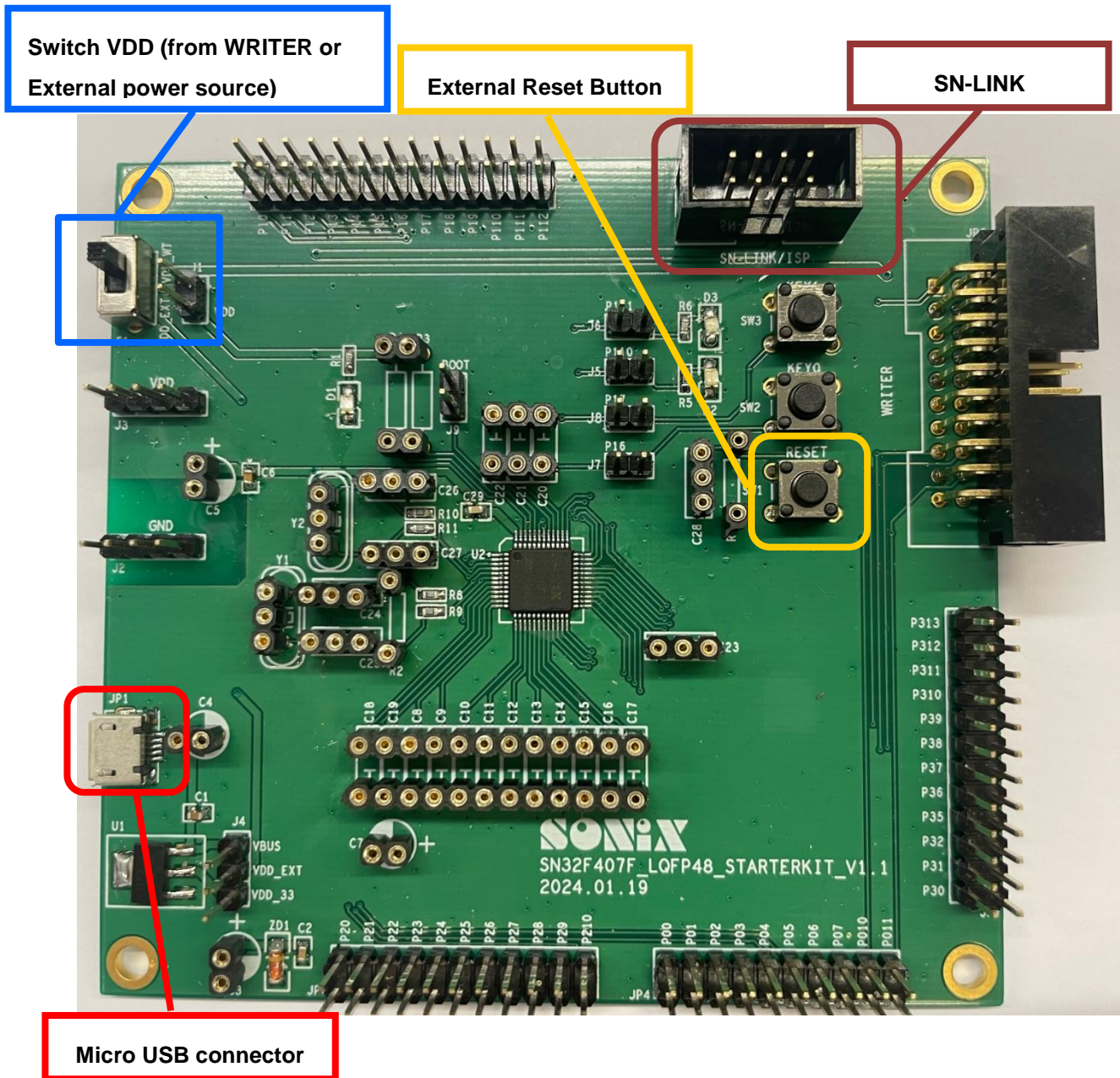
SN-LINK-V3.0

IDE/CMSIS

2.1 ICE

1. Please execute SN-LINK Package to install SN-LINK-V3.0 related files.
2. Connect SN-LINK-V3.0 debugger and PC via USB cable.

2.2 SN32F400 Starter-kit Board



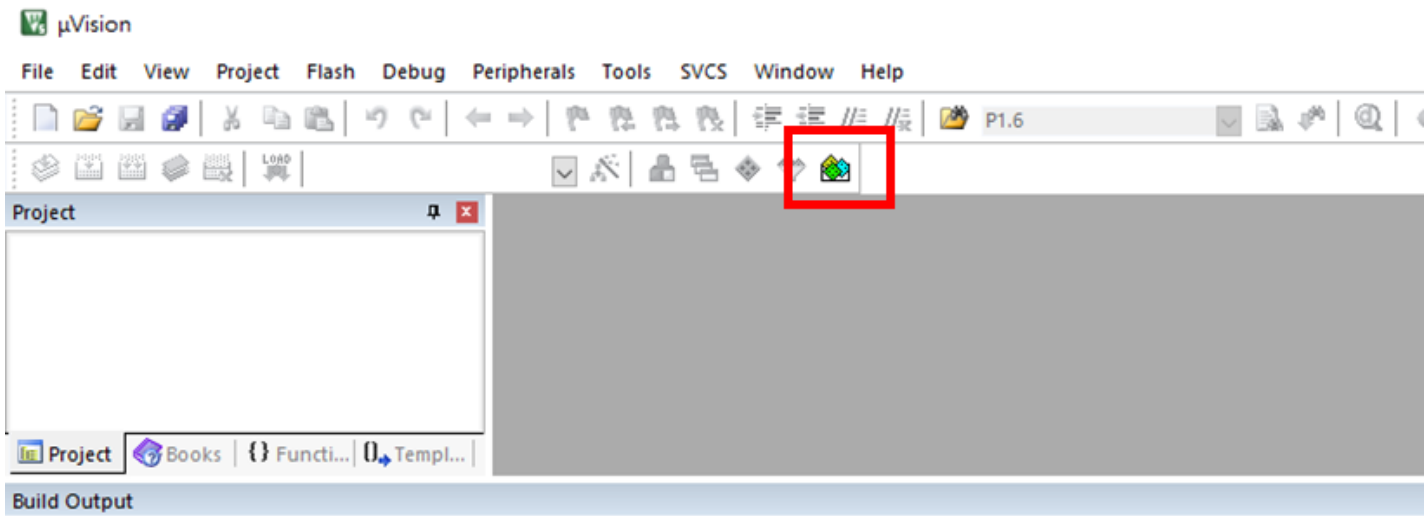
- JP1 : Micro USB connector.
- S1 : Choose the source of VDD (5.0V/3.3V on board or WRITER). Please switch to VDD_WT if the WRITER is used.
- JP2 : Connector for SN-LINK debugger
- J9 : Short to enter Boot loader for ISP process

2.3 KEIL MDK-ARM

1. Please link to <http://www.keil.com/arm/mdk.asp> to download MDK V5.XX and install to default path (C:\Keil_v5)

* **Note: The new CMSIS architecture of can support Live update feature, so the user can use Pack Installer to check whether SONiX updates the latest CMSIS files on the server or not, and can update easily. We strongly recommend to update Keil MDk v5.XX, and translate the project to MDK v5.**

2. Execute KEIL MDK, and then press “Pack Installer” button.

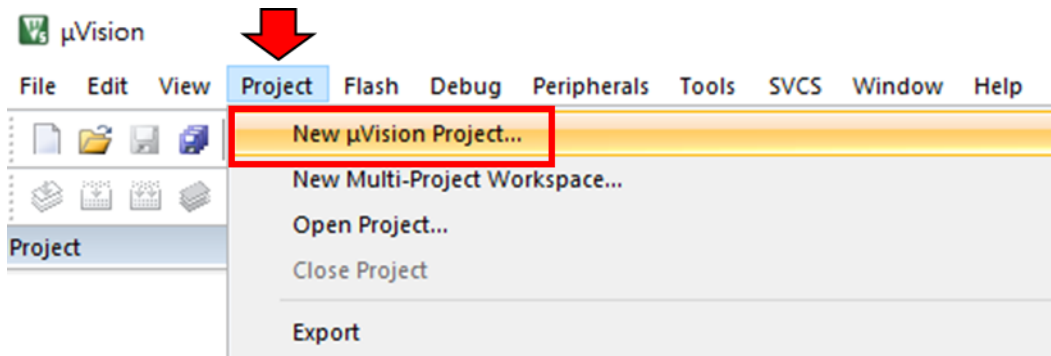


3. Please double click SONiX.SN32F4_DFP.x.y.z.pack inside SN32F400_Startkit_Package_VX.X\Pack to install SN32F400 CMSIS related files.
4. Please double click Hex2Bin_Vxx.exe inside SN32F400_Startkit_Package_VX.X\Tools\Hex2Bin to install HexConverter, it will be installed in the same path which Keil MDK is installed. In Chapter 3, we will show you how to set the project setting to use this tool, which can help to generate the bin file and calculate the checksum.

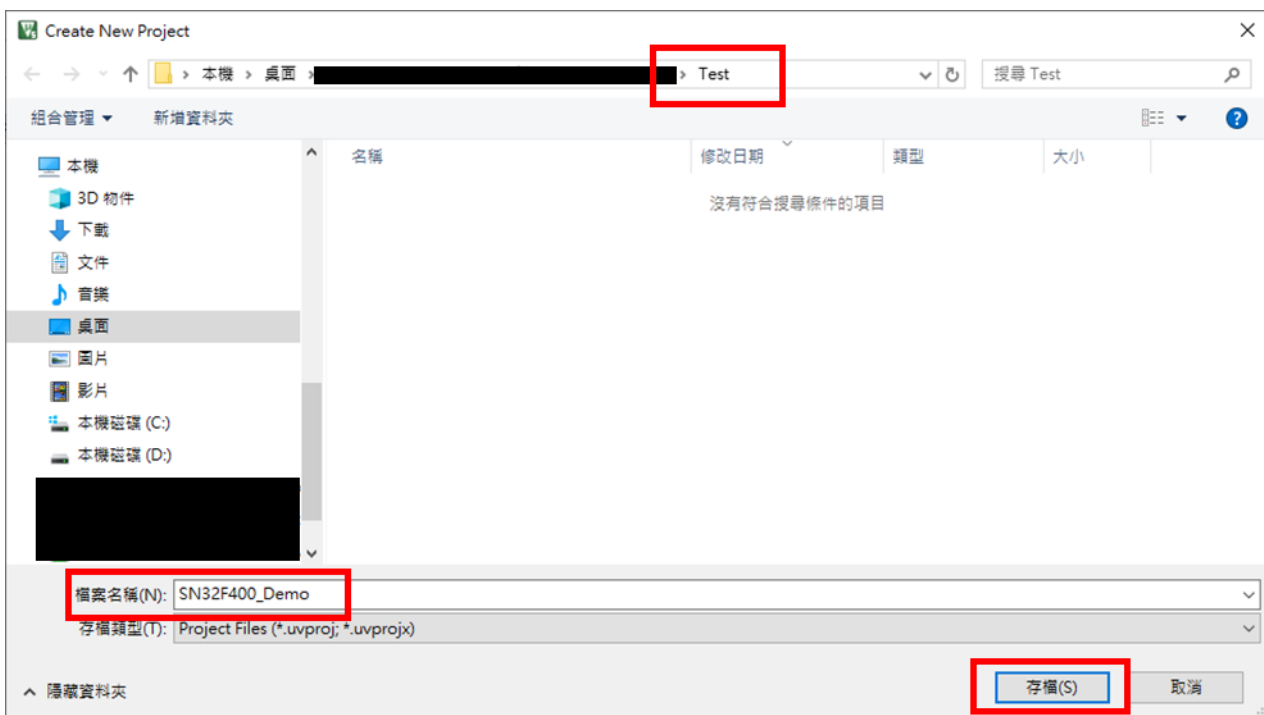
3 DEVELOP

3.1 Build a New Project

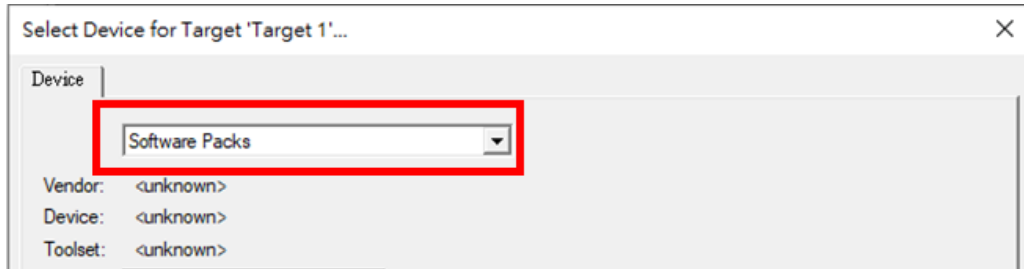
1. Press "Project", and then select "New uVision Project".



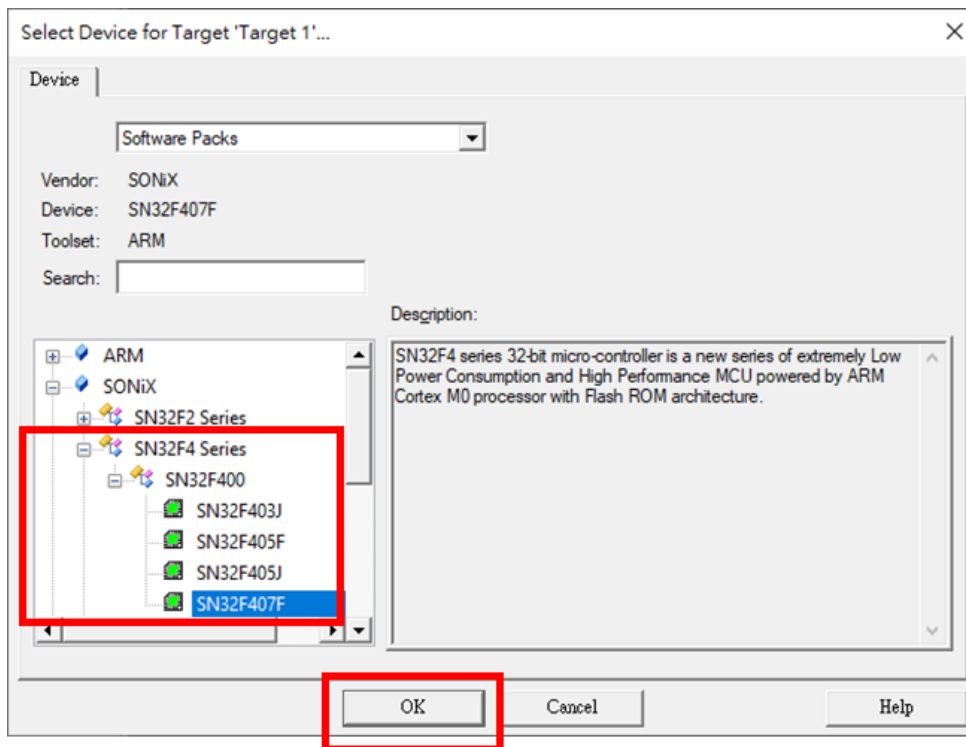
2. Choose the folder which is used to build the project, fill in the project name, and press "Save(S)".



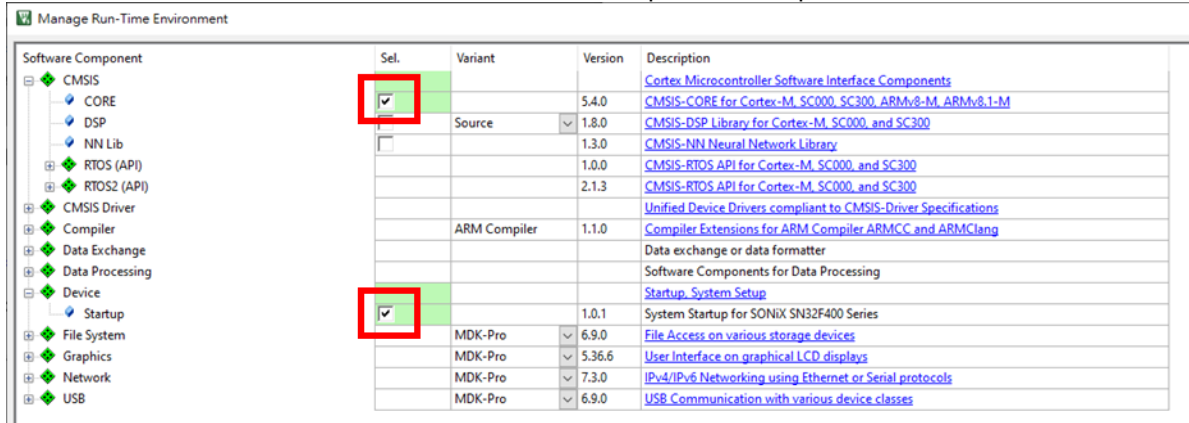
3. Please select “Software Packs”.



4. Search "SONiX", take SN32F400 series MCU for example, select "SN32F4 Series" → "SN32F400" → Either package ("SN32F407F" for example), and then press "OK" button.



5. Please check both "CMSIS"→"CORE" and "Device" →"Startup", and then press "OK" button.



6. The figure below shows the MCU related CMSIS files are loaded.

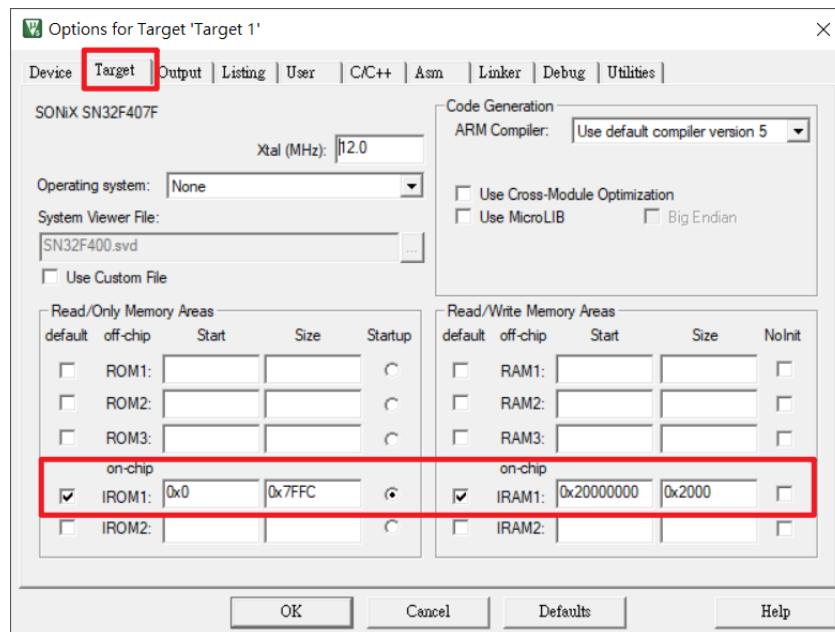


7. Press "Target Options".

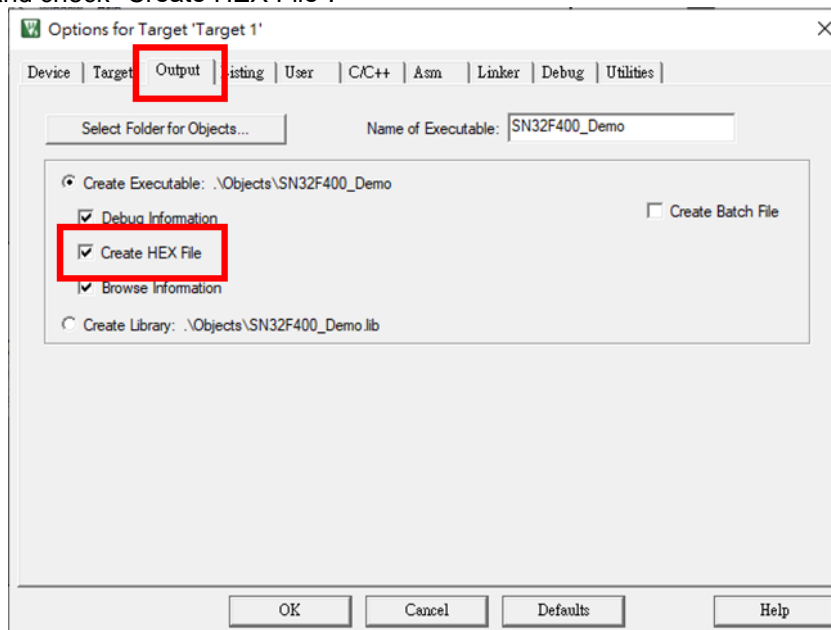


7.1 Press "Target", set the proper size of ROM and RAM correctly for each MCU type.

A. SN32F400 (ROM 32KB, RAM 8KB)

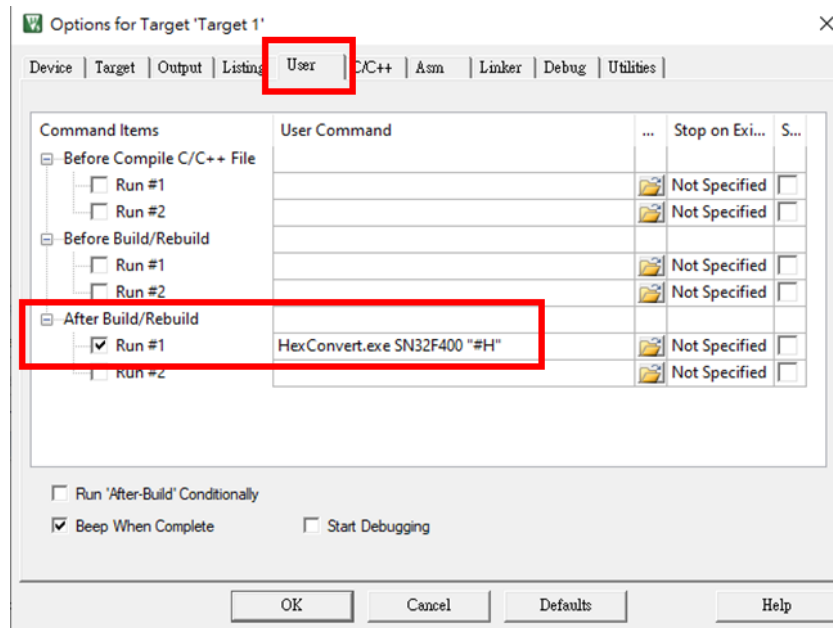


7.2 Press "Output", and check "Create HEX File".



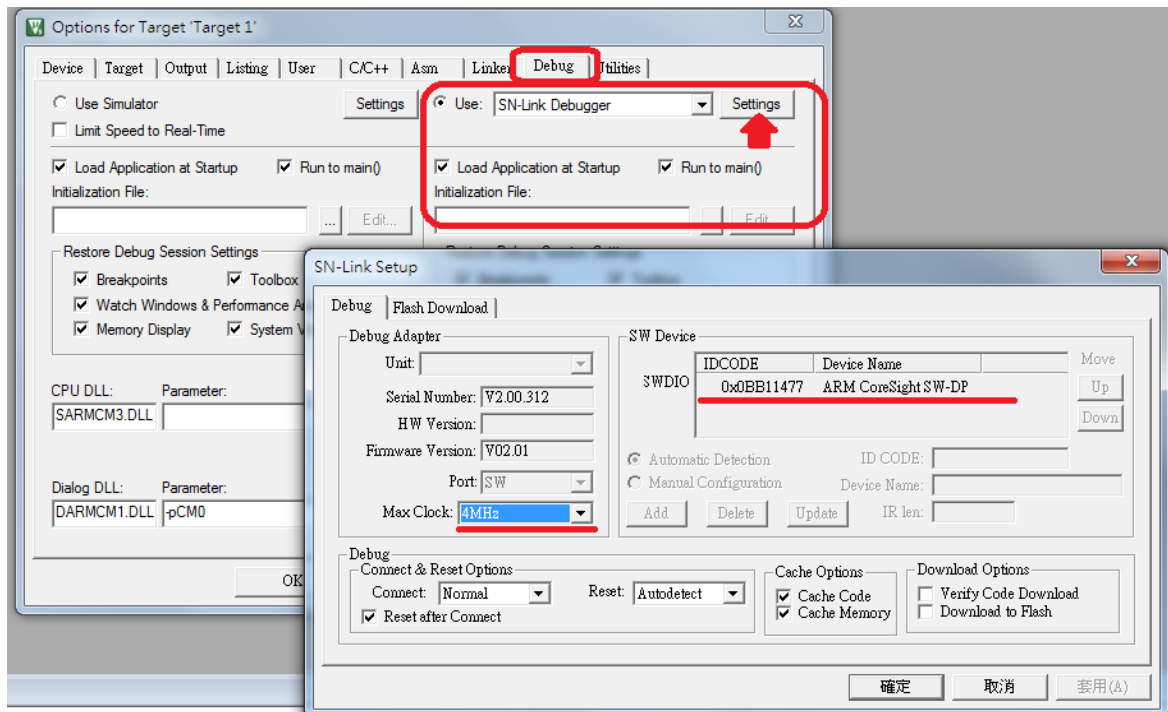
7.3 Press "User", check "Run #1:", and then fill in the command below for each MCU type.

SN32F400 → HexConvert.exe SN32F400 "#H"

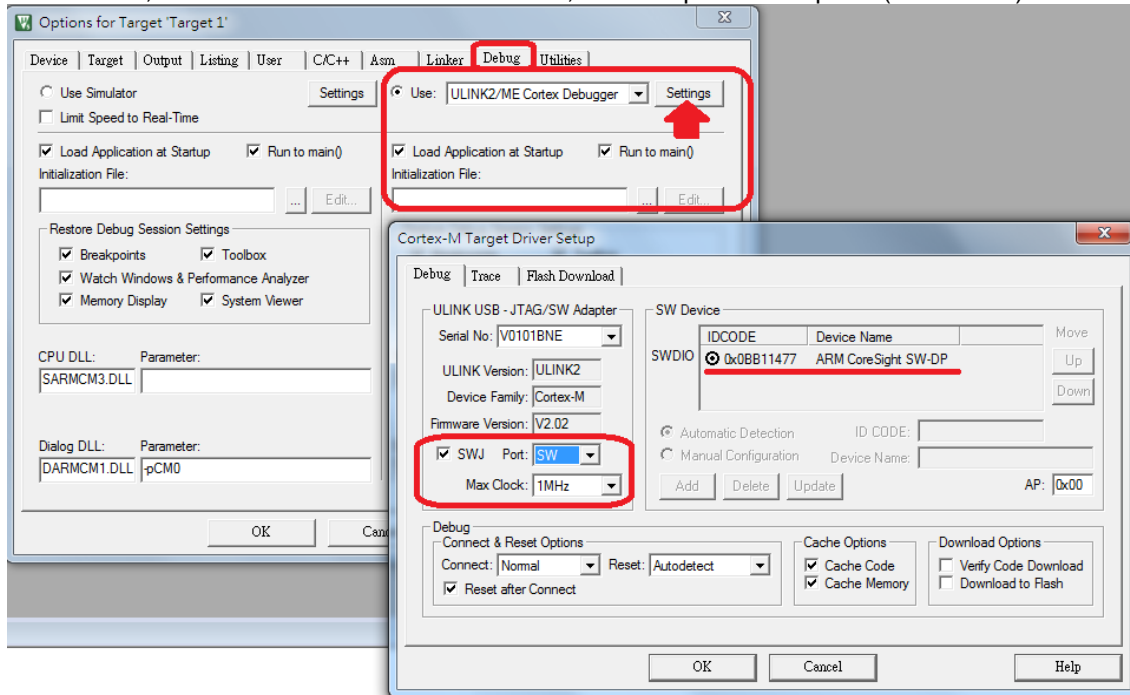


7.4 Press "Debug", and then press "Settings" to configure the ICE used. KEIL shall be able to get and the status of MCU if ICE is configured and connected correctly.

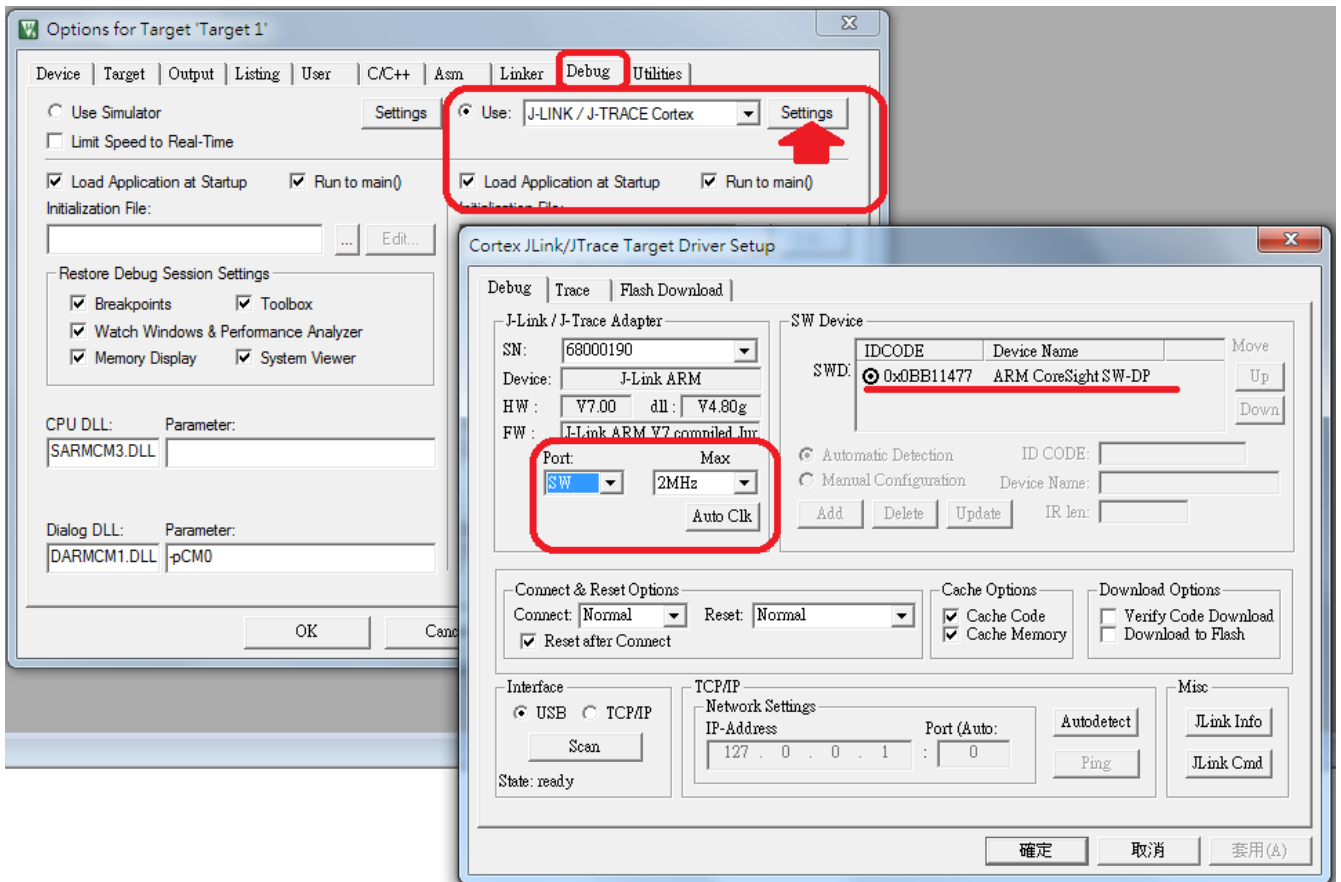
A. Use SN-LINK, setup the ICE speed (Max Clock)



B. Use ULINK2, check "SWJ" and set Port as "SW", and setup the ICE speed (Max Clock)

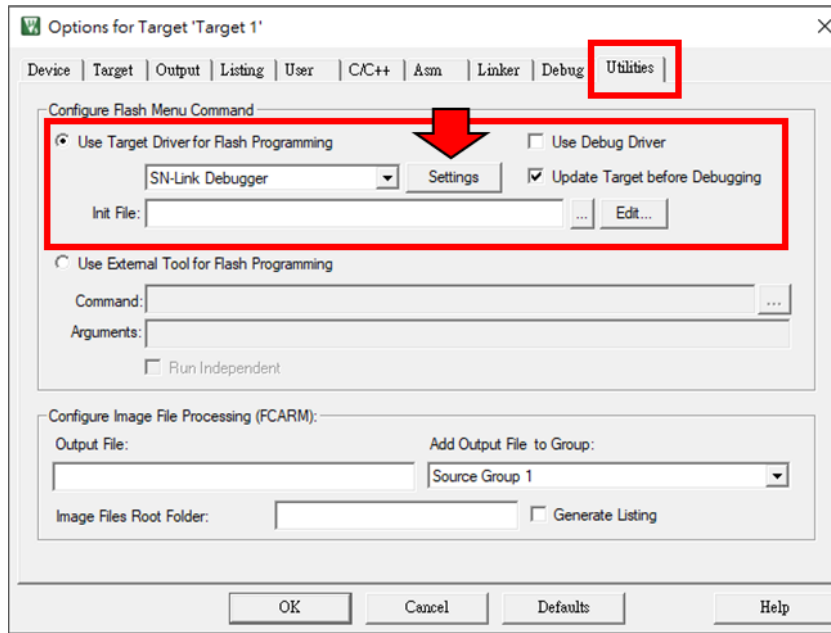


C. Use J-LINK, set Port as "SW" , and setup the ICE speed (Max)



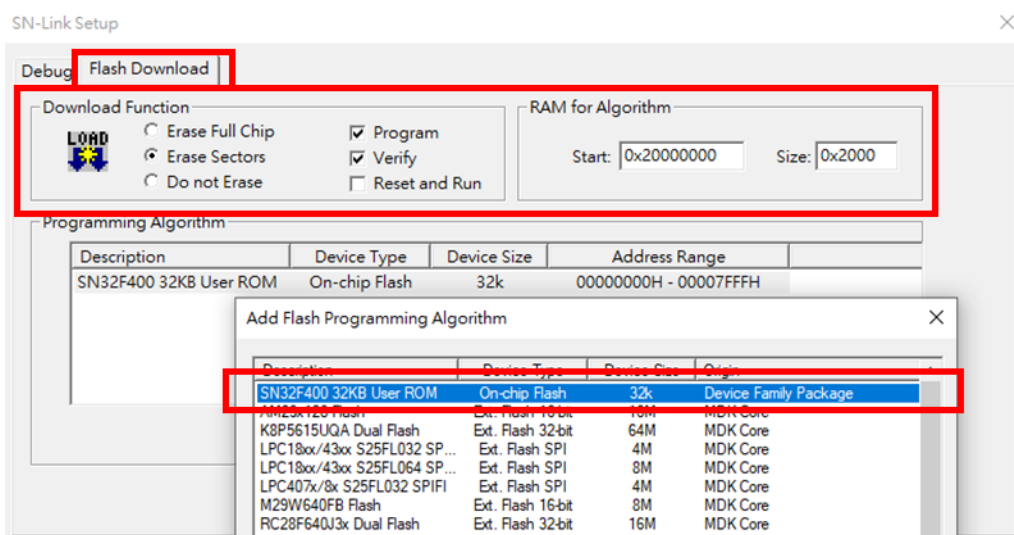
D. If other ICE is used, please refer to its user guide.

7.5 Press "Utility", select the used ICE, and then press "Settings".



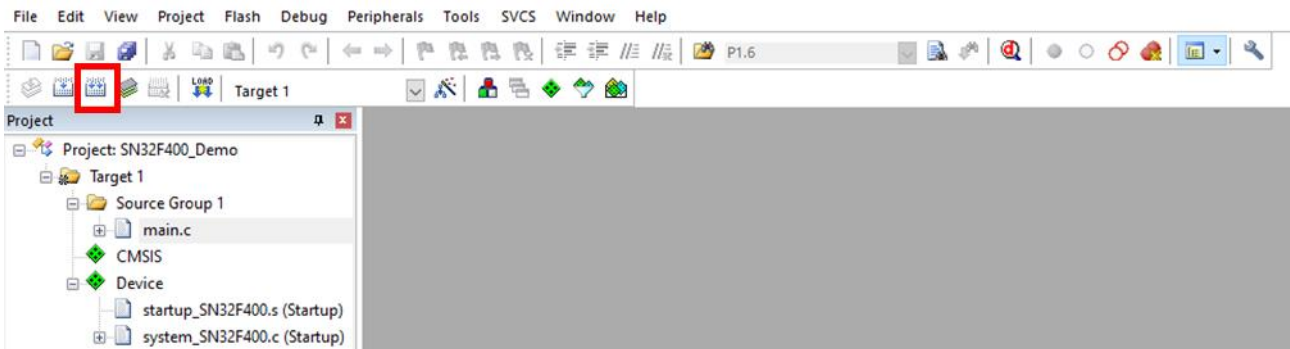
* **Note: Please do NOT select "Use Debug Driver".**

7.6 Configure and choose the correct Programming algorithm for MCU in use as below.

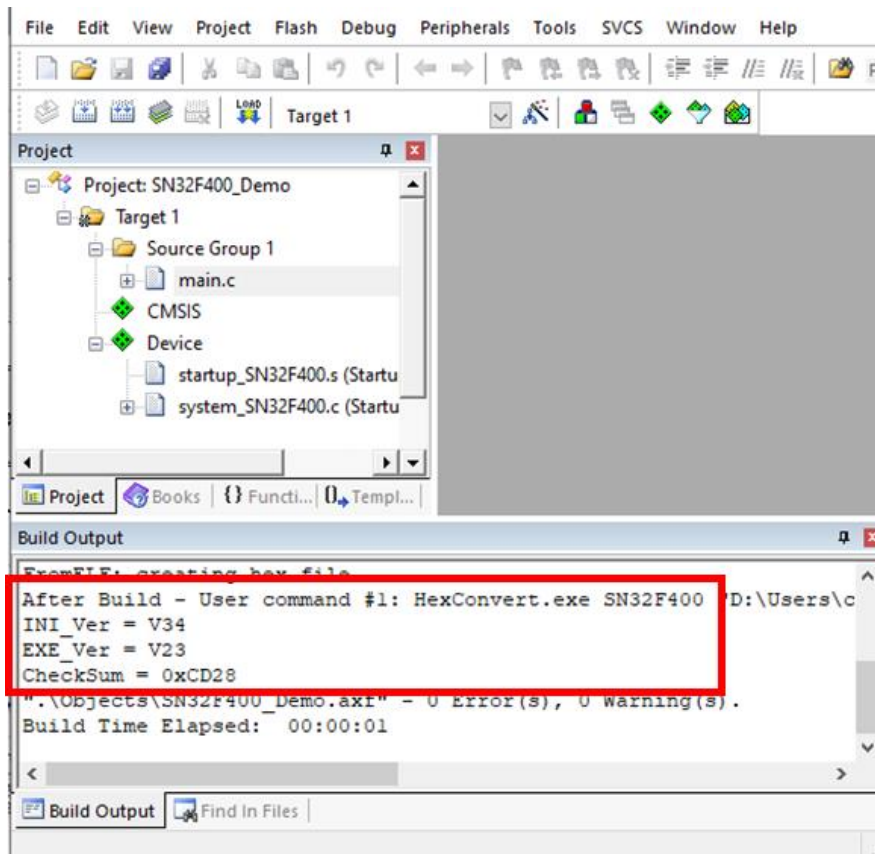


* **Note: Click "Add" → "SN32F400 32KB User ROM" shall be seen in the pop window. If "SN32F400 32KB User ROM" can NOT be found, please make sure the step 3 of [3.1 Build a New Project](#) is completed.**

- Return to main page to start coding.
- After coding, click the “Rebuild” button as below, Keil MDK will start to compile.

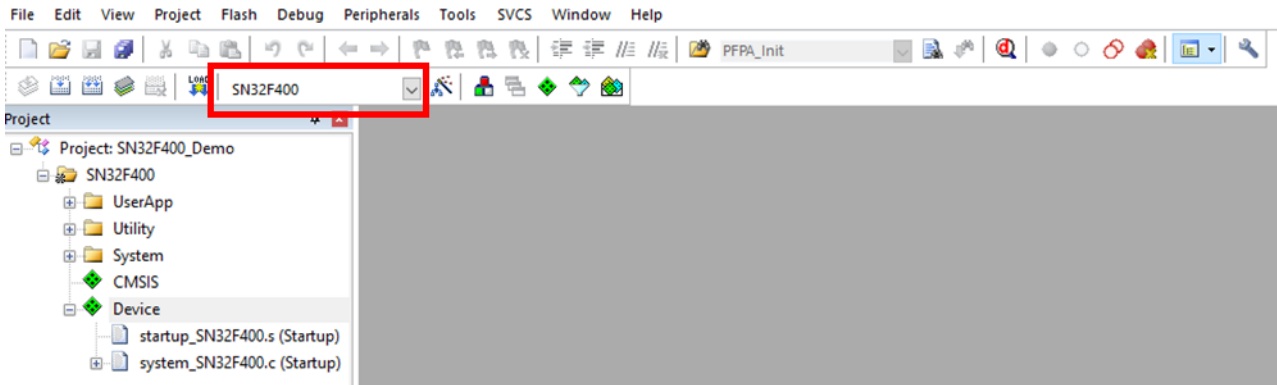


- If compile successfully, the version of HexConverter and the calculated Checksum will be showed in the message box.

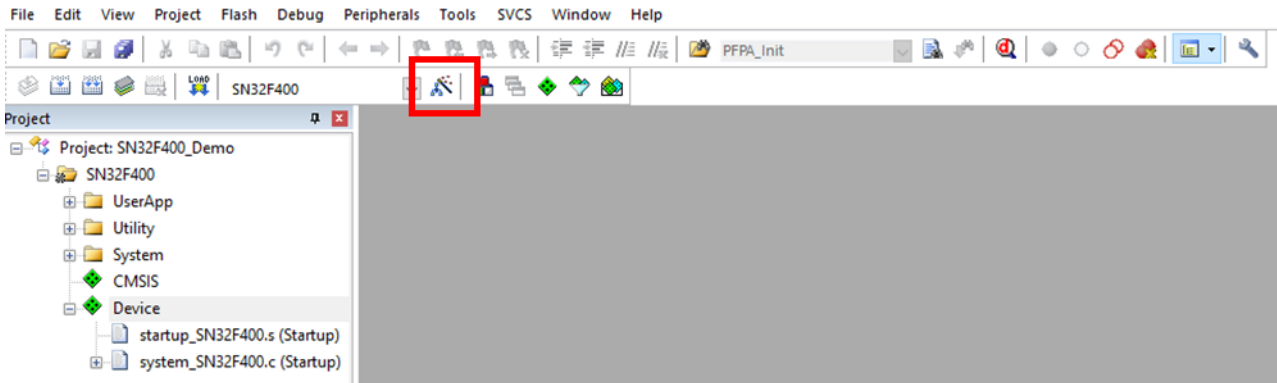


3.2 Use SONiX Sample Code

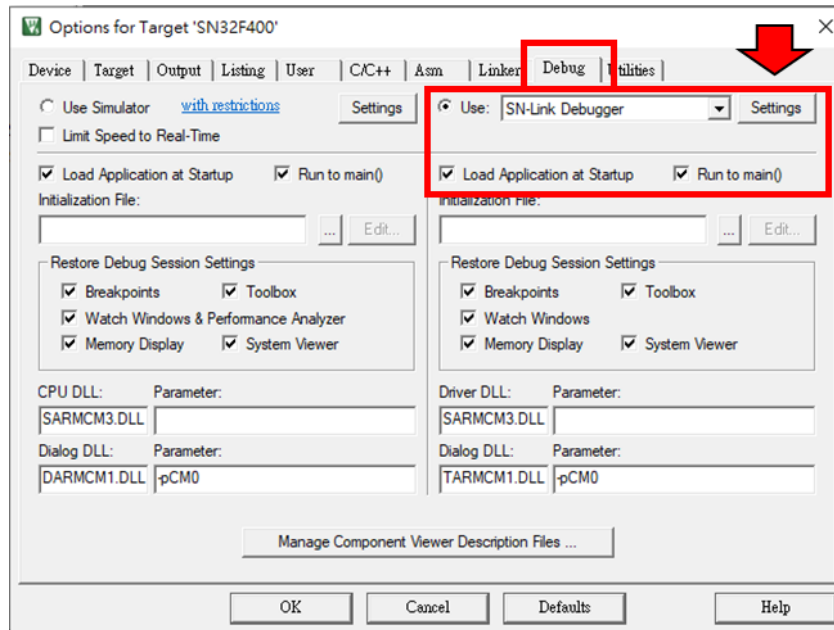
1. Open any project of SN32F400 Firmware Library with MRK-ARM, and then select the desired target MCU.



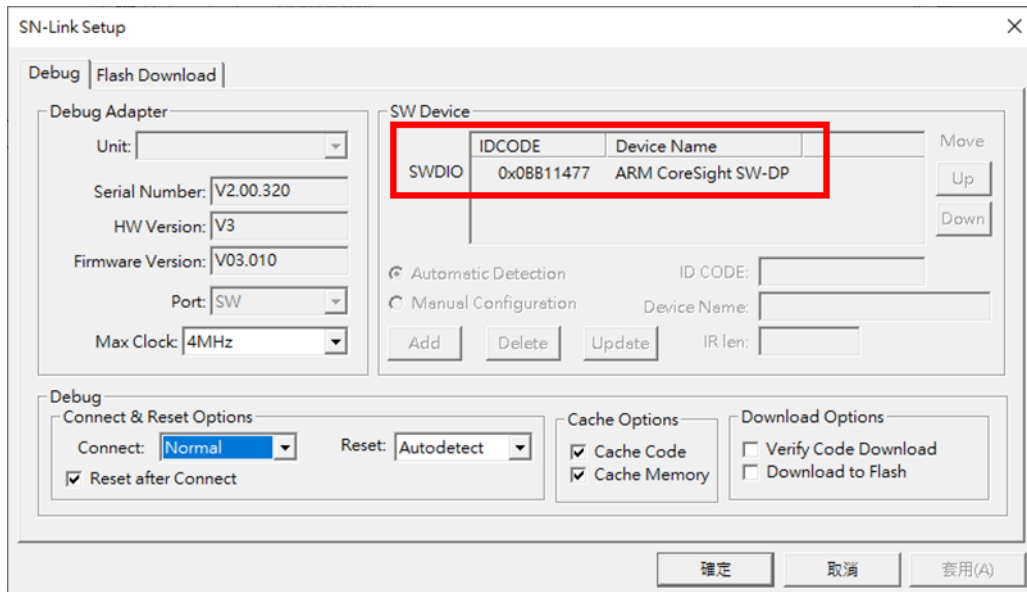
2. Press "Target Options"



3. Enter "Target Options" page, click "Debug" tab, and set as the following settings, and then click "Settings" button.

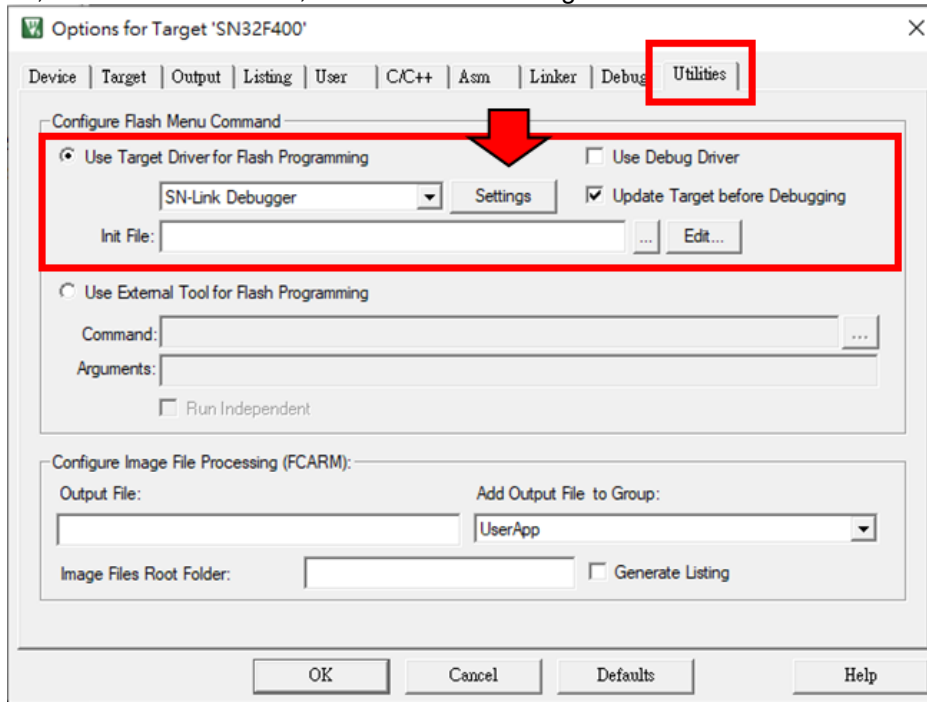


4. Enter Setup page, KEIL shall be able to get and the status of MCU if ICE is connected correctly.



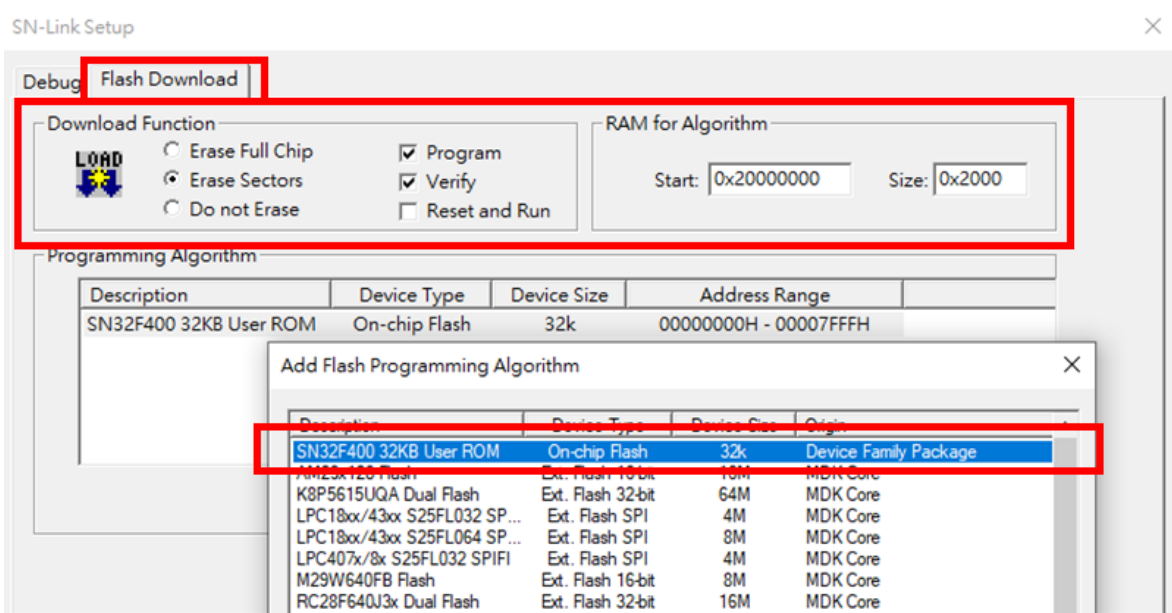
* **Note:** If the used ICE is NOT SN-LINK, please refer to the step 7.4 of [3.1 Build a New Project](#).

5. Press "Utility" tab, choose the used ICE, and then click "Settings" button.



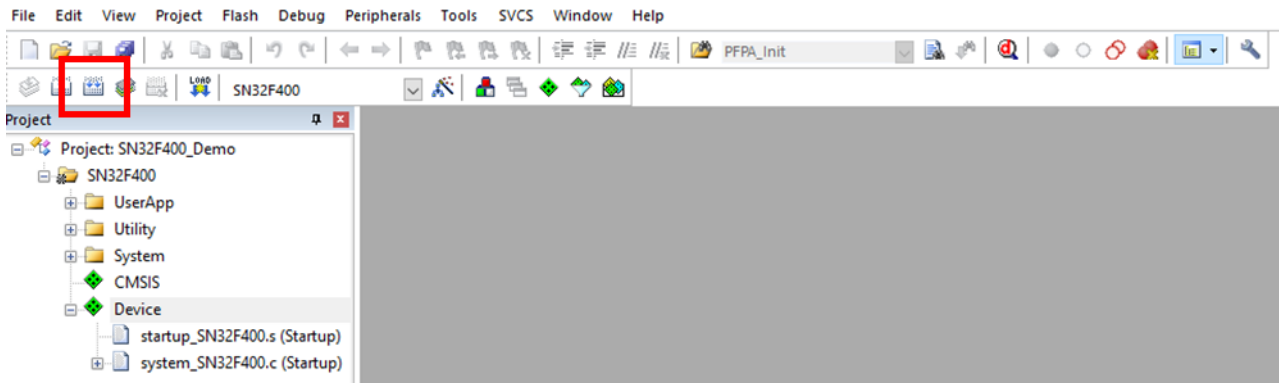
* **Note: Please do NOT select "Use Debug Driver".**

6. The following setting shall be seen.

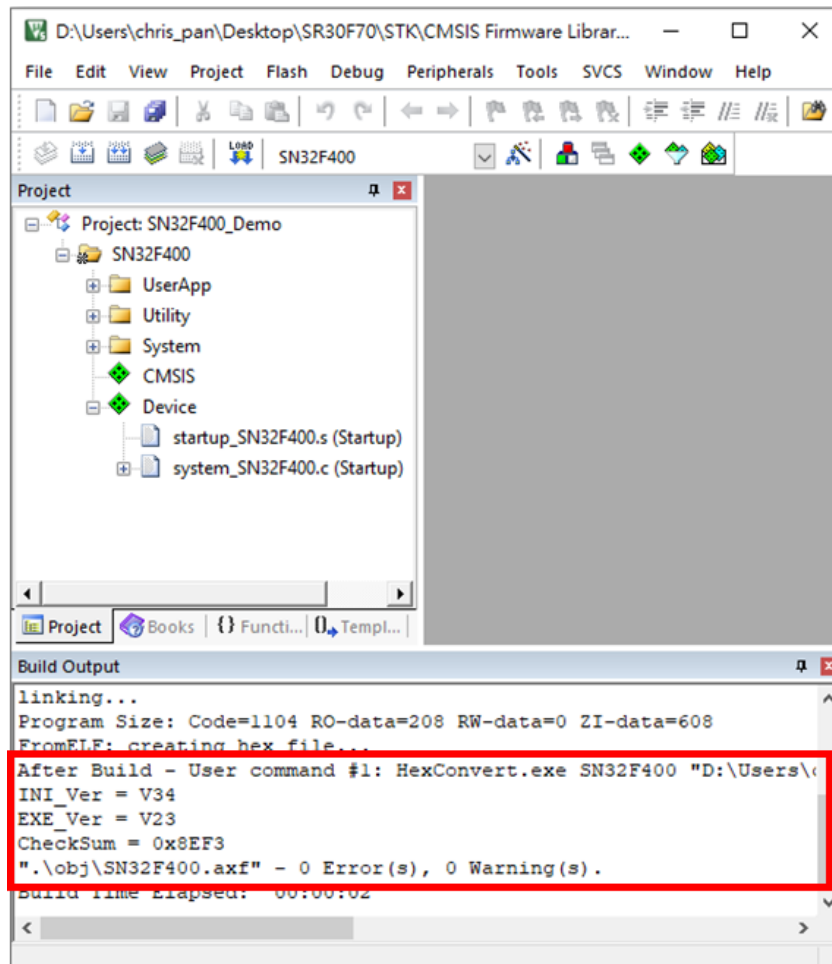


* **Note: Click "Add" → "SN32F400 32KB User ROM" shall be seen in the pop window. If "SN32F400 32KB User ROM" can NOT be found, please make sure the step 3 of [3.1 Build a New Project](#) is completed.**

7. Please click “OK” to exit “Target Options”.
8. Click the “Rebuild” button as below, Keil MDK will start to compile.

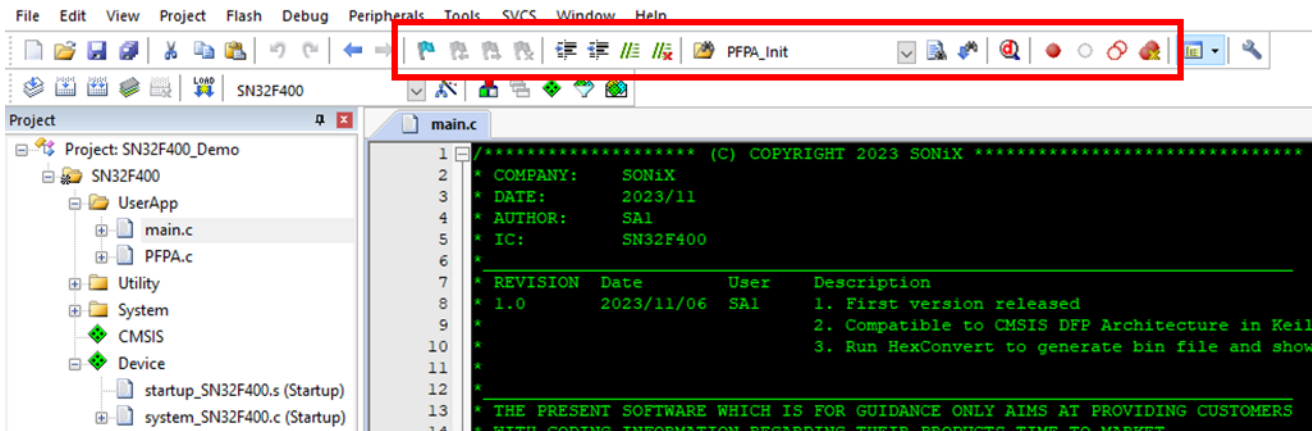


9. After compiling, the version of HexConverter and the calculated Checksum will be showed in the message box.

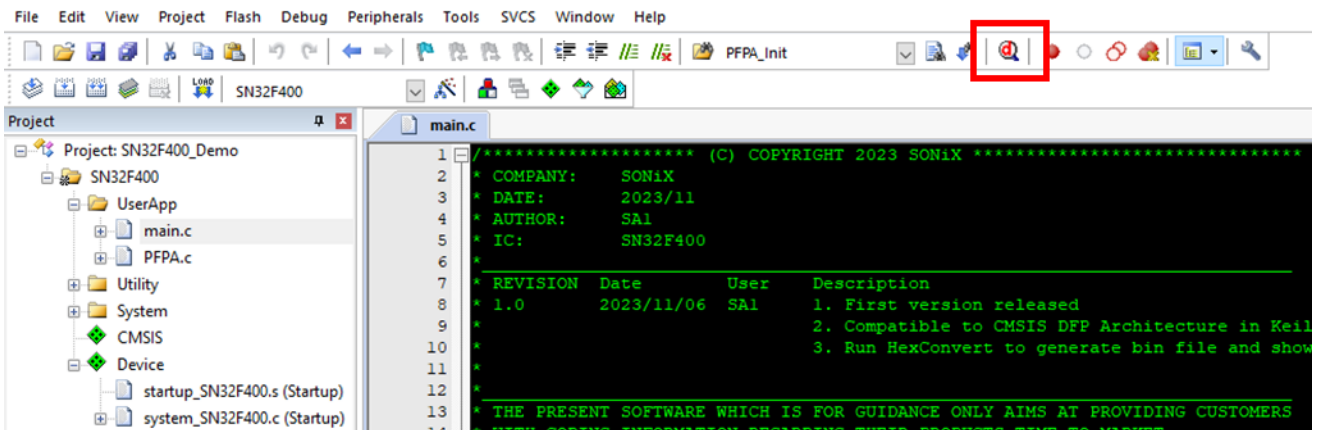


3.3 Debug

The users can develop and debug with MDK-ARM after above settings.



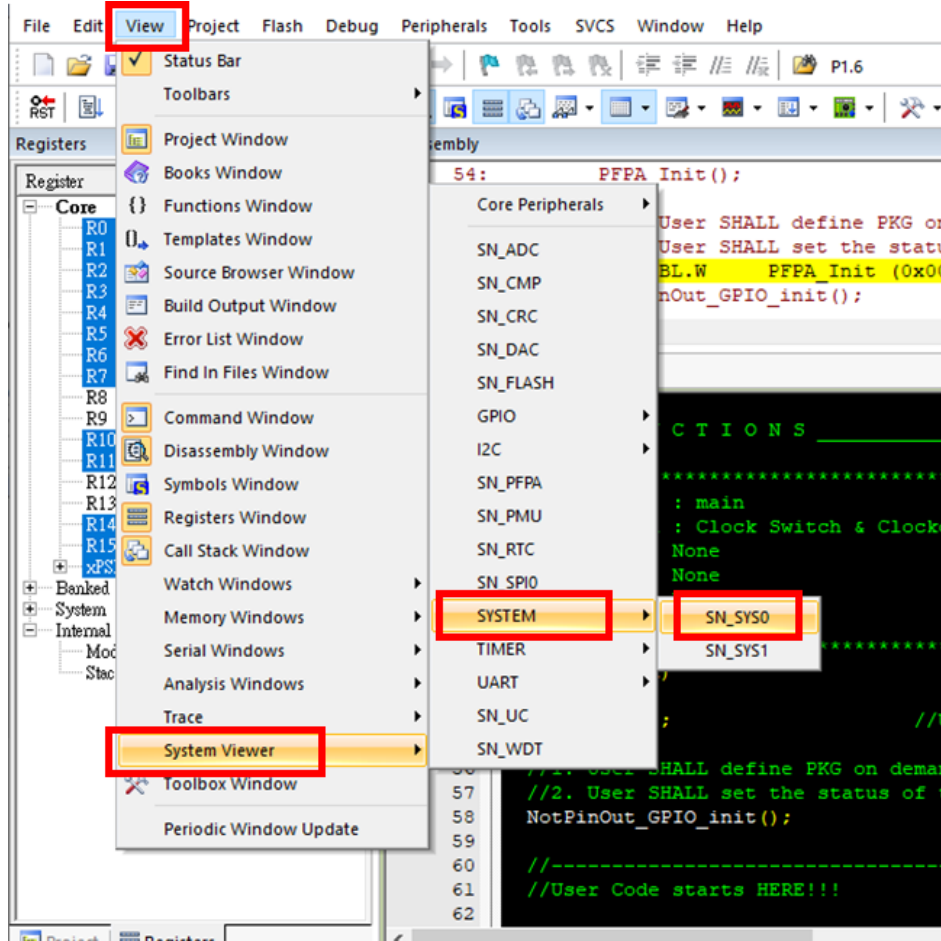
Click the button (“Start/Stop Debug Session”) below to start debugging.



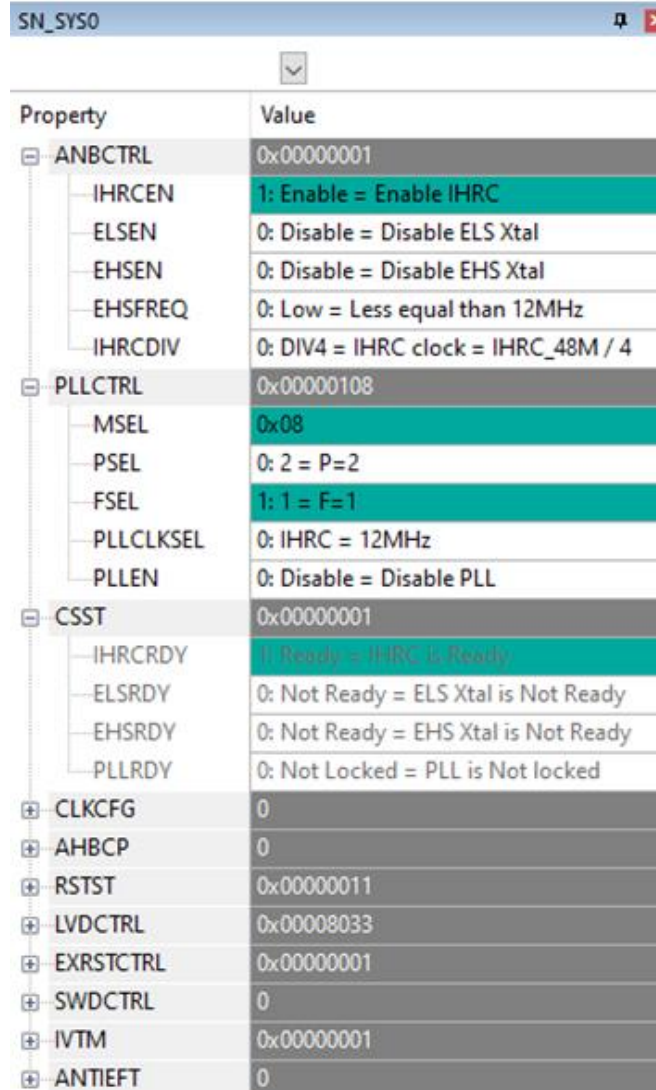
3.3.1 CMSIS-SVD (System View Debug)

SVD is the debug standard of CMSIS, and it is a useless debug tool for users.

1. Before entering debug mode, click "View", and then select the registers which to be watched from the "System Viewer" list.



2. Take SN_SYS0 as example, we can see the following messages in KEIL debug window.



Property	Value
ANBCTRL	0x00000001
IHRcen	1: Enable = Enable IHRC
ELSEN	0: Disable = Disable ELS Xtal
EHSen	0: Disable = Disable EHS Xtal
EHSFREQ	0: Low = Less equal than 12MHz
IHRCDIV	0: DIV4 = IHRC clock = IHRC_48M / 4
PLLCTRL	0x00000108
MSEL	0x08
PSEL	0: 2 = P=2
FSEL	1: 1 = F=1
PLLCLKSEL	0: IHRC = 12MHz
PLEN	0: Disable = Disable PLL
CSST	0x00000001
IHRCDY	1: Ready = IHRC is Ready
ELSRDY	0: Not Ready = ELS Xtal is Not Ready
EHSRDY	0: Not Ready = EHS Xtal is Not Ready
PLLRDY	0: Not Locked = PLL is Not locked
CLKCFG	0
AHBCP	0
RSTST	0x00000011
LVDCTRL	0x00008033
EXRSTCTRL	0x00000001
SWDCTRL	0
IVTM	0x00000001
ANTIEFT	0

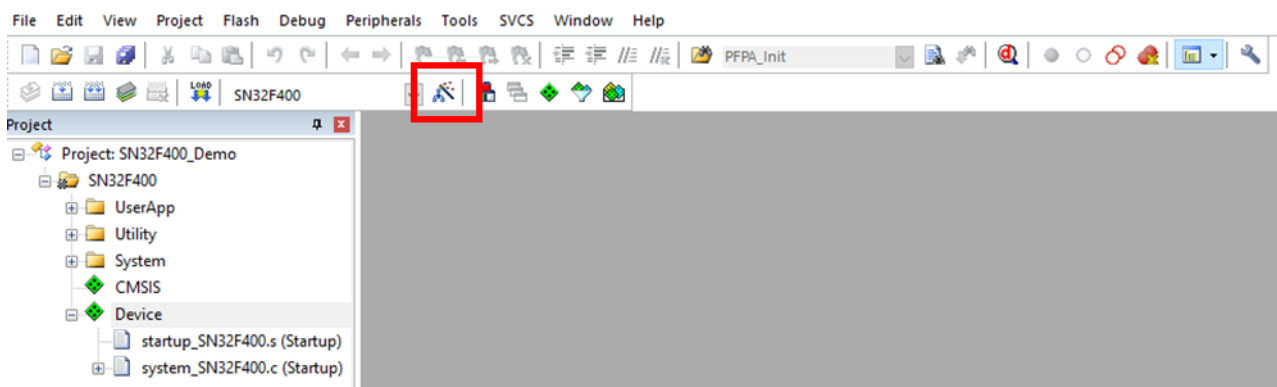
3.4 Migrate ARM Compiler 5 to ARM Compiler 6

ARM Compiler 6 uses the LLVM compiler framework, offering more optimization level options than ARM Compiler 5 and generating more efficient code.

Nevertheless, the code remains partially compatible with previous versions of the ARM Compiler. This chapter will explain how to upgrade projects and code from ARM Compiler 5 to ARM Compiler 6.

3.4.1 Target Options

1. Open the project source code for ARM Compiler 5.
2. Press “Target Options”



3. Enter "Target Options" page, click "Target" tab, and set as the following settings.

ARM V5 Compiler	
ARM V6 Compiler	

- * **Note:** The version used for 「Use default compiler version」 depends on the installed toolchain version. For example:
- * When installing the 「MDK Essential 5.30」 toolchain, the V5 compiler version is 「V5.06 update 6 (build 750)」, the V6 compiler version is 「V6.14」.

4. After switching to ARM Compiler V6, the "C/C++" tab will change to "C/C++ (AC6)." Please follow the settings shown in the image below.

ARM V5 Compiler	
ARM V6 Compiler	

5. The following lists commonly required code modifications:

5.1 `__attribute__`

ARM V5 Compiler	<pre>__attribute__((at(0x000000e0))) __attribute__((at(0x000000f0)))</pre>
ARM V6 Compiler	<pre>__attribute__((section(".ARM.__at_0x000000E0"))) __attribute__((section(".ARM.__at_0x000000F0")))</pre>

5.2 `__irq`

ARM V5 Compiler	<pre>__irq void HardFault_Handler(void) { NVIC_SystemReset(); }</pre>
ARM V6 Compiler	<pre>void HardFault_Handler(void) { NVIC_SystemReset(); }</pre>

5.3 `__ASM`

ARM V5 Compiler	<pre>__ASM void CRC_Set_UCRCEN(void) __attribute__((section(".ARM.__at_0x400"))); __ASM void CRC_Set_UCRCEN(void) { push {r0-r7, lr} ldr r0, =0x40038000 ldr r1, [r0] movs r2, #0x08 orns r1, r2 str r1, [r0, #0x00] nop pop {r0-r7, pc} }</pre>
ARM V6 Compiler	<pre>void CRC_Set_UCRCEN(void) __attribute__((section(".ARM.__at_0x400"))); void CRC_Set_UCRCEN(void) { __ASM ("push {r0-r7, lr} \n" "ldr r0, =0x40038000 \n" "ldr r1, [r0] \n" "movs r2, #0x08 \n" "orns r1, r2 \n" "str r1, [r0, #0x00] \n" "nop \n" "pop {r0-r7, pc} \n"); }</pre>

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