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S1C31 Family
Peripheral Circuit
Sample Software Manual

arm

SEIKO EPSON CORPORATION

Rev.1.0

Evaluation board/kit and Development tool important notice

1. This evaluation board/kit or development tool is designed for use for engineering evaluation, demonstration, or development purposes only. Do not use it for other purposes. It is not intended to meet the requirements of design for finished products.
2. This evaluation board/kit or development tool is intended for use by an electronics engineer and is not a consumer product. The user should use it properly and in a safe manner. Seiko Epson dose not assume any responsibility or liability of any kind of damage and/or fire coursed by the use of it. The user should cease to use it when any abnormal issue occurs even during proper and safe use.
3. The part used for this evaluation board/kit or development tool may be changed without any notice.

NOTICE

Table of Contents

1. Overview

This manual describes how to use the peripheral circuit sample software included in the S1C31xxx peripheral circuit sample software package. The peripheral circuit sample software is intended to show how to use the peripheral circuit library to control the S1C31xxx peripheral circuits.

In addition to this manual, please also refer to the following.

- S1C31xxx Technical Manual … Microcontroller details. Available from Seiko Epson website.
- S5U1C31xxxTx Manual … Evaluation Board details. Available from Seiko Epson website.
- Manual for debug probe and integrated development environment

1.1 Operating Environment

Before running the peripheral circuit sample software, prepare the following components:

- Evaluation Board
  - S5U1C31xxxTx evaluation board equipped with S1C31 Family
- Debug Probes *1
  - IAR Systems I-jet or SEGGER J-Link
- Integrated Development Environment
  - IAR Embedded Workbench for ARM® (IAR EWARM) or MDK-ARM® (uVision)
- S1C31 Setup Tool Package
  - Flash loader and configuration files (.svd, etc.)
- Other Devices (option)

*1: I-jet is available only with IAR EWARM. J-Link is available for both IAR EWARM and MDK-ARM.

2 Peripheral circuit sample software package configuration

2.1 Folder configuration

The configuration of the S1C31xxx peripheral circuit sample software package is as follows.

```
S1C31xxxSamplePKG_very_yy.zip
[S1C31xxxSamplePKG_very_yy]
        |- [Licenses] : License group
        |- [Drivers] : Driver group
        |       |- [board] : Drivers related to the evaluation board
        |       |       |- [S5U1C31xxxTx]
        |       |       |       |- [ARM]
        |       |       |       |- [IAR]
        |       |       |       |- board.c/.h : Evaluation board setting program
        |       |       |       |- settings.h : Definition file for setting the function of the evaluation board
        |       |       |       |- …
        |       |- [CMSIS] : CMSIS driver
        |       |       |- [Device]
        |       |       |       |- [S1C31xxx]
        |       |       |               |- [Include]
        |       |       |               |       |-S1C31xxx.h : CMSIS peripheral circuit access layer header file
        |       |       |               |       |- …
        |       |       |               |- [Source]
        |       |       |                       |- [ARM]
        |       |       |                       |- [IAR]
        |       |       |                       |       |- startup_S1C31xxx.s : CMSIS startup program
        |       |       |                       |- system_S1C31xxx.c : CMSIS peripheral circuit access layer program
        |       |       |- [Driver]
        |       |       |       |- [Include]
        |       |       |       |       |- Driver_EEPROM.h : CMSIS EEPROM emulation library driver definition
        |       |       |       |       |- Driver_Flash.h : CMSIS self-programming library driver definition
        |       |       |       |       |- …
        |       |       |       |- [Source]
        |       |       |               |- Driver_EEPROM.c
        |       |       |- [SVD]
        |       |- [sePeripheralLibrary] : Peripheral circuit library
        |               |- se_clg.c/.h
        |               |- se_i2c.c/.h
        |               |- …
        |- [Middlewares] : Middleware group
        |       |- [seEepromLibrary] : EEPROM emulation library
        |       |- [seFlashLibrary] : Self-programming library driver definition
        |       |- …
        |- [Projects] : Sample software group
        |       |- [Applications] : Various application software
        |       |       |- [BOOTLOADER] : Sample software for boot loader
        |       |       |- [EEPROM] : Sample software for EEPROM emulation library
        |       |       |- [FLASH] : Sample software for self-programming library
        |       |       |- [IEC60730SELF] : Sample software for self-testing
        |       |       |- …
        |       |- [Demonstration] : Various demonstration software
        |       |- [Examples] : Peripheral circuit sample software
        |               |- [CLG] : Each peripheral circuit function
        |               |       |- [ARM] : Project for MDK-ARM
        |               |       |- [IAR] : Project for IAR EWARM
        |               |       |- main.c
        |               |- [I2C]
        |               |- [PPORT]
        |               |- …
        |               |- [WORKSPACE] : A workspace that collects project of each peripheral circuit function
        |- [Tools] : Tools used by the sample software
        README_e.txt
        README_j.txt
```

Figure 2.1.1 Configuration of the S1C31xxx peripheral circuit sample software package

2.2 Sample Software configuration

The sample software (project) included in the S1C31xxx peripheral circuit sample software package uses various drivers included in the "Drivers" folder. The software layer of the sample software is shown in Figure 2.2.1.

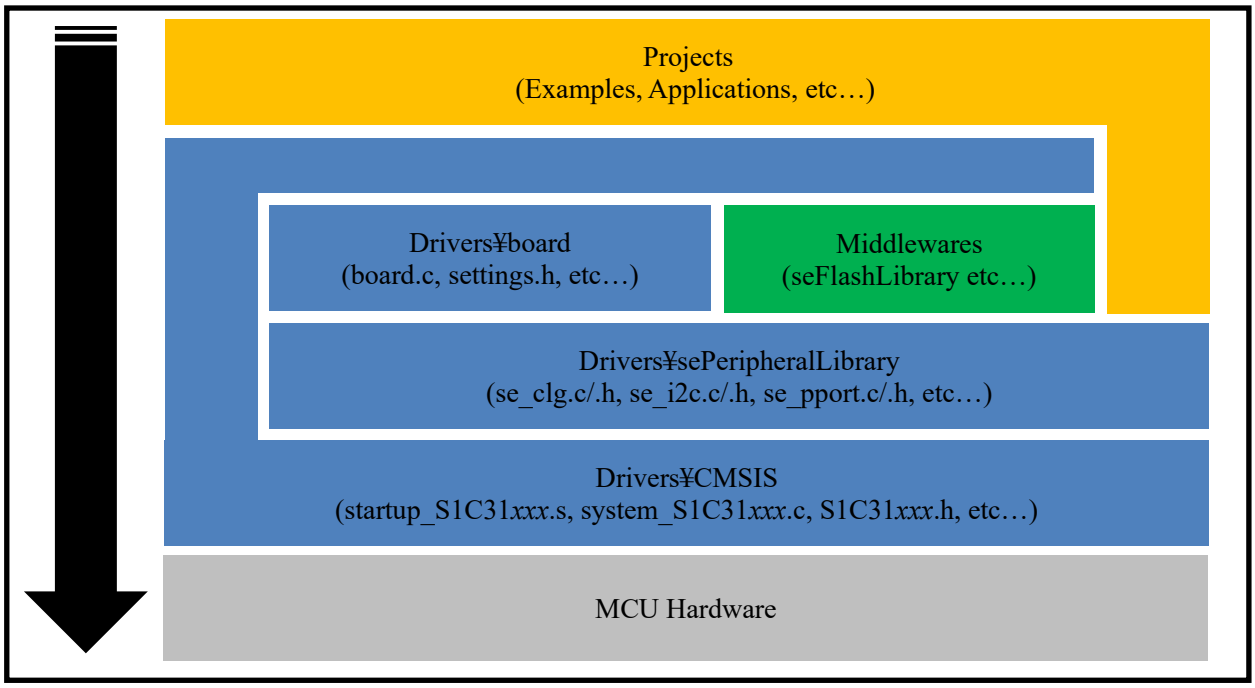

Figure 2.2.1 Software layer of sample software

In addition, as shown in Figure 2.2.2, the sample software is started from the CMSIS startup program (startup_S1C31xxx.s), and the system initialization process is executed at startup.

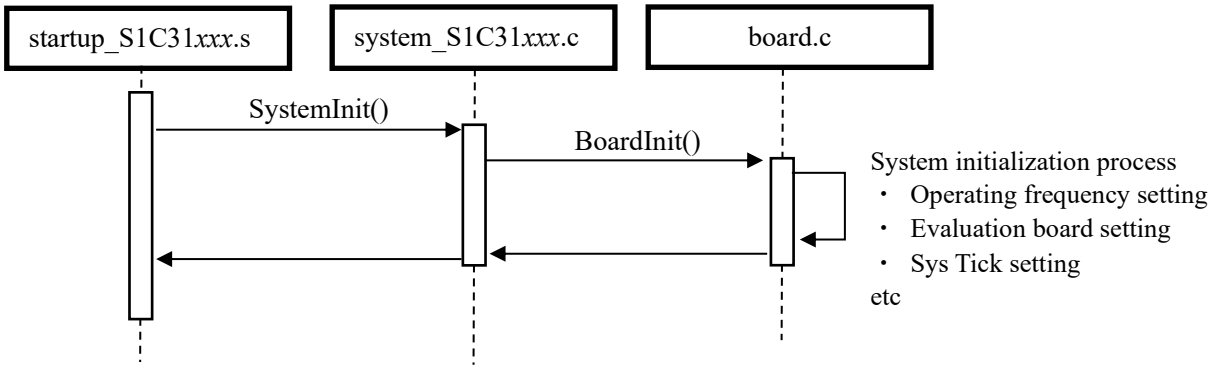

Figure 2.2.2 Sample software startup sequence

2.3 Evaluation board settings

The settings.h file contained in the “Drivers ¥ board” folder defines the function settings of the evaluation board. Table 2.3.1 shows the setting constants and settings in the settings.h file. These setting constants are commented out and undefined by default. If necessary, uncomment it.

Table 2.3.1 S1C31 Family Evaluation Board Definition

Configuration Feature	Defined	Un-defined
UART_PRINTF	The standard library printf function outputs to the UART console. Additional hardware is required. For Keil IDE, this configuration feature should be defined.	The semihosting library printf function outputs to the IAR IDE terminal window.
EXECUTE_ON_OSC3	The CPU switches to the clock that optionally can be run from crystal or internal trimmable oscillator in the BoardInit function.	The CPU uses the default clock.
OSC3_AUTOTRIMMING_ON IOSC_AUTOTRIMMING_ON	OSC3 or IOSC trimming is performed in the BoardInit() function to achieve higher CPU clock accuracy.	OSC3 or IOSC trimming is not performed. This results in a shorter boot time.
OSC3_SRC_XTAL	Crystal is source of OSC3	Internal RC oscillator is source of OSC3
CACHE_ENABLED	The cache is enabled for the Flash targets. No importance for Debug targets,	The cache is not enabled for the Flash targets.
TICKLESS_ENABLED	SYSTICK interrupt is disabled.	SYSTICK interrupt is used to keep track of the elapsed CPU time since the last boot.
BOOT_LOADER	Executing code is a boot loader.	Executing code is an application.
QSPI_MODE_SINGLE	QSPI SINGLE mode is selected.	QSPI DUAL or QUAD modes are selected.
SPIA_DMA	Use DMA for SPIA_MASTER and SPIA_SLAVE projects.	Do not use DMA for SPIA_MASTER and SPIA_SLAVE projects.

Notes:

- The definition of “Configuration Feature” is different for each model.
- To use the UART console for input/output, un-comment UART_PRINTF in the settings.h file.
- In cases where the CPU deep sleep function is used, un-comment TICKLESS_ENABLED in the settings.h file.

3 Peripheral circuit sample software execution

This section describes how to execute the peripheral circuit sample software.

3.1 Advance preparation

3.1.1 Software download

Follow the steps below to download and install the software.

(1) Download the integrated development environment

Download the integrated development environment (IAR EWARM or MDK-ARM (μVision)). After downloading, follow the installer to install.

(2) Download the S1C31 setup tool package

Download the S1C31 setup tool package (.exe) from Seiko Epson microcontroller website. Please download from the following.

Seiko Epson microcontroller website > EPSON Web Sites > Semiconductors > Microcontrollers > Arm® > Software Development Tool

After downloading, follow the installer to install the flash loader and configuration file suitable for your integrated development environment.

(3) Download the S1C31xxx peripheral circuit sample software package

Download the S1C31xxx Peripheral circuit sample software package (.zip) from Seiko Epson microcontroller website. Please download from the following.

Seiko Epson microcontroller website > EPSON Web Sites > Semiconductors > Microcontrollers > Arm® > Application Note / Sample Program

3.1.2 Hardware Connections

Use the following to execute and debug the peripheral circuit sample software.

- S5U1C31xxxTx evaluation board
- Debug probes (IAR Systems I-jet or SEGGER J-Link)

About details of the hardware connection, refer to the “S5U1C31xxxTx Manual”.

3.1.3 Connection with USB adapter for UART

The peripheral circuit sample program that uses UART uses a USB adapter for UART. By connecting the evaluation boat to the PC using the USB adapter for UART, UART communication with the PC becomes possible. Figure 3.1.3.1 show the connection for an USB Adapter for UART to the evaluation board. About the connection with the evaluation board, refer to "S5U1C31xxxTx Manual".

To perform UART communication, it is necessary to build the sample program with the definition of UART_PRINTF in the settings.h file enabled (see Section 2.3). In addition, it is necessary to start the serial communication terminal software on the PC and set the serial port. Table 3.1.3.1 shows the serial port setting values.

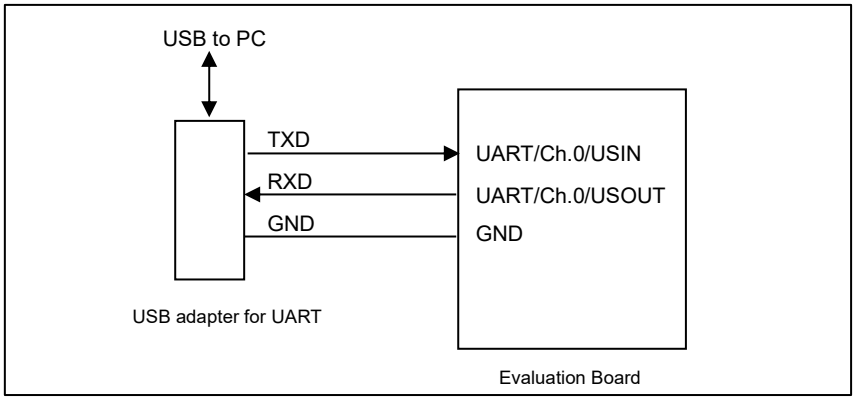

Figure 3.1.3.1 USB Adapter for UART Wiring to Evaluation Board

Table 3.1.3.1 Serial Port Settings for Terminal Software

Parameter	Setting Value
Baud rate	115200 bps
Data	8 bits
Stop bits	1 bits
Parity	None

Notes: USB adapter for UART used in Figure 3.1.3.1 is a commercial product, not provided by Seiko Epson. Please purchase as necessary.

3.2 Execution procedure by IAR EWARM

3.2.1 Start IAR EWARM

Start IAR EWARM. About details on the version of IAR EWARM used to evaluate the peripheral circuit sample software, refer to “README_j.txt” in the S1C31xxx peripheral circuit sample software package.

3.2.2 Workspace Open

The S1C31xxx Peripheral Circuit Sample Software Package provides projects for each peripheral circuit function as peripheral circuit sample software. It provides a workspace that collects projects for each peripheral circuit function.

To open the workspace, click [File] > [Open Workspace] on the IAR EWARM menu, move to the “Projects¥Examples¥WORKSPACE¥IAR” folder and select the “Examples.eww” file. (Figure 3.2.2.1)

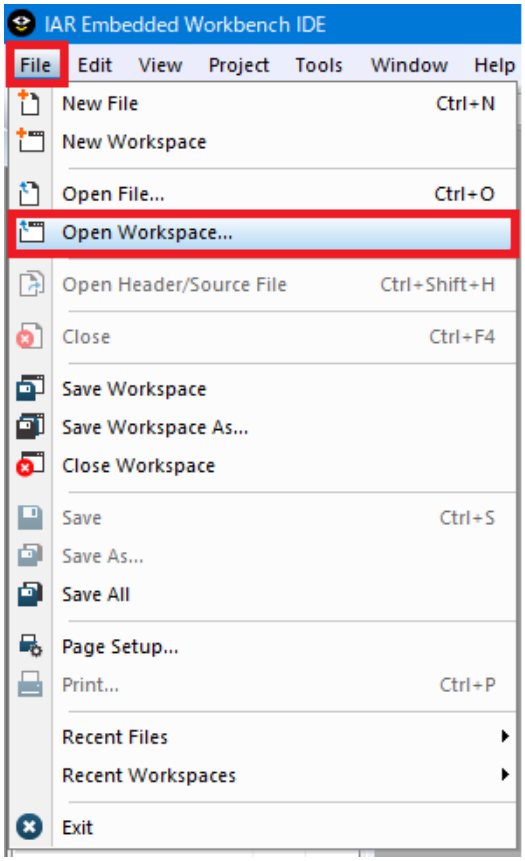

Figure 3.2.2.1 Workspace Open

3.2.3 Active Project Selecting

To build the project, right-click the project to be built and executed in [Workspace] window on IAR EWARM and select the [Set as Active] in right-clicked menu. By using the drop-down list at the top of the [Workspace] window, the active project and build configuration can be selected at the same time (Figure 3.2.3.1).

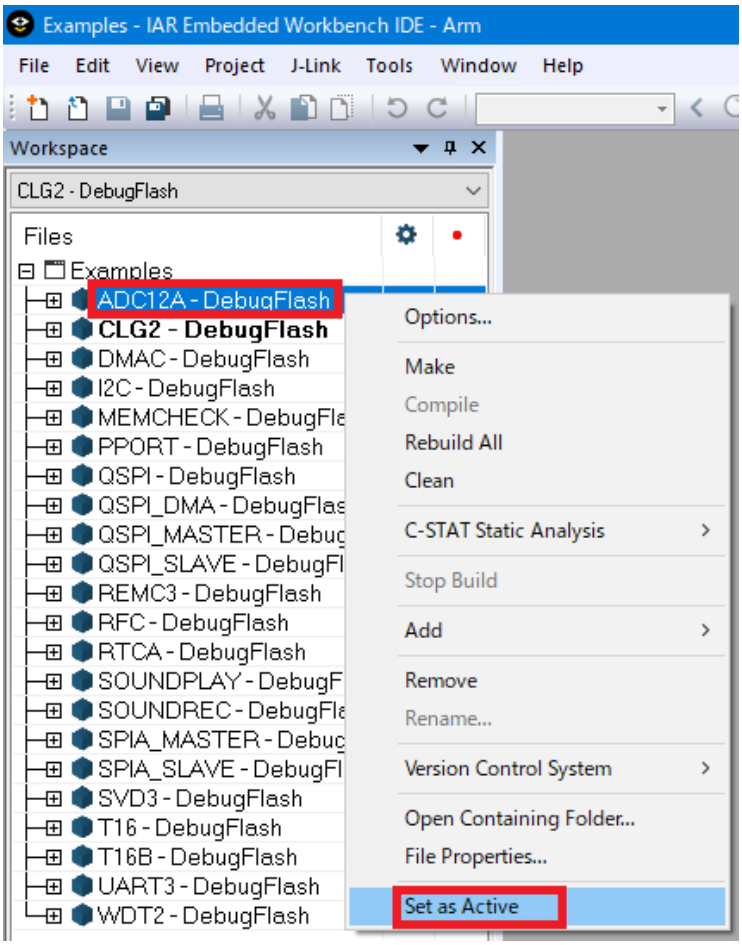

Figure 3.2.3.1 Active Project Setting

3.2.4 Debug Probe Setting

When connecting a debug probe to the evaluation board for debugging, it is necessary to set the driver according to the type of debug probe used.

To select the debug probe driver, follow the procedure below. (Figure 3.2.4.1)

(1) Select the [Project] > [Option] in the IAR EWARM menu.

(2) Select the [Debugger] in the [Category] list on the [Options for node "{project}"] dialog.

(3) Select the [Setting] tab, and then select the debug probe in the [Driver] drop-down list as shown below.

- When using the I-jet , select the "I-jet/JTAGjet".
- When using the J-Link, select the "J-Link/J-Trace".

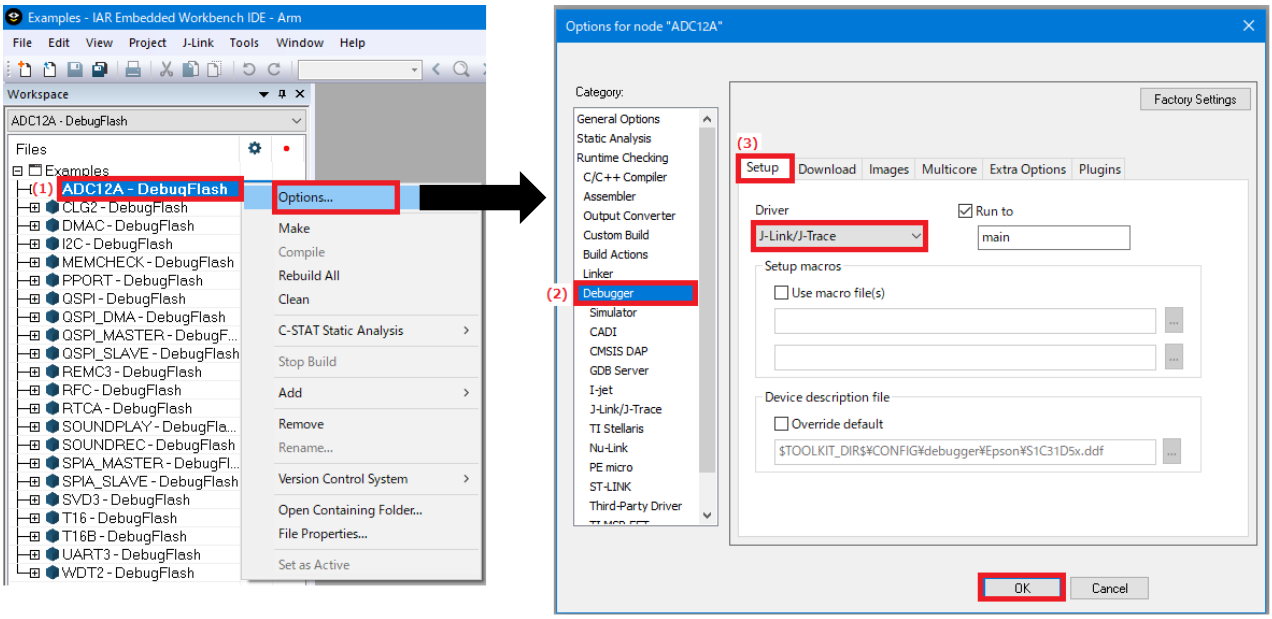

Figure 3.2.4.1 Debug Probe Setting

3.2.5 Flash Loader Setting

Set up a flash loader to download the internal Flash memory for active projects. To set the flash loader, follow the procedure below. (Figure 3.2.5.1).

(1) Select the [Project] > [Option] in the IAR EWARM menu.

(2) Select the [Debugger] in the [Category] list on the [Options for node "{project}"] dialog.

(3) Select the [Download] tab.

(4) Enable the [Use flash loader(s)] checkbox.

(5) Enable the [Override default .board file] checkbox.

(6) Click the [...] button and select "S1C31xxx_int.board" as a board file.

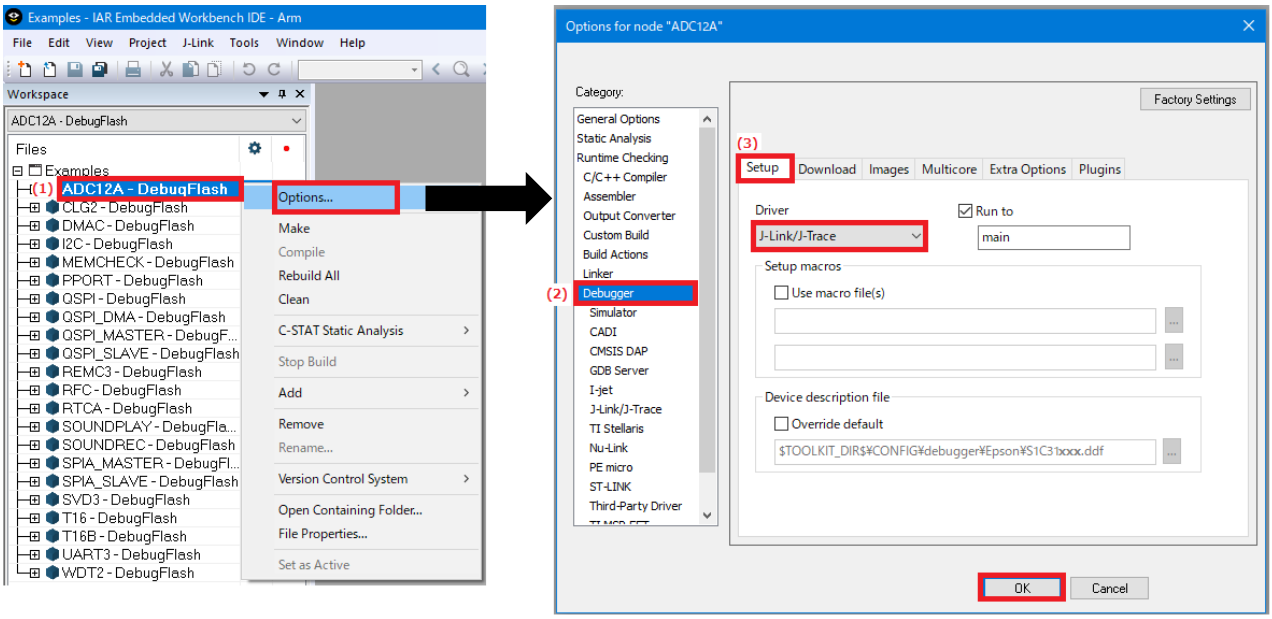

Figure 3.2.5.1 Flash Loader Setting

3.2.6 Project Build

To build an active project, select one of the build commands [Make] or [Rebuild All] from the [Project] in the IAR EWARM menu (Figure 3.2.6.1).

Also, the batch build option to build the projects of all peripheral circuit function at once is available. To use the batch build option, select the [Project] > [Batch build…] > “all_DebugFlash” in the IAR EWARM menu.

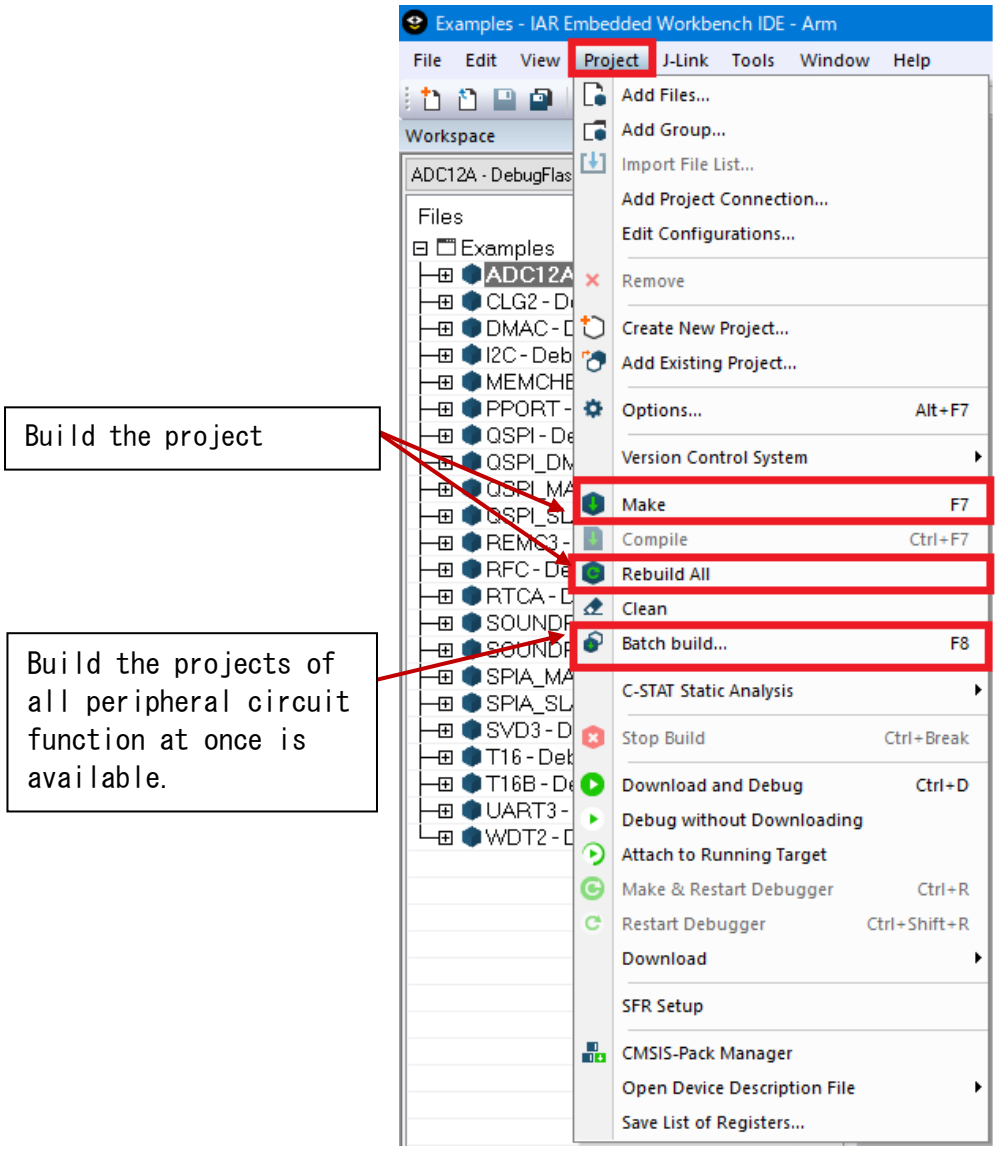

Figure 3.2.6.1 Build Commands

3.2.7 Project Download and Debug

Following a successful build, download the program image of the active project to MCU on the evaluation board. To download the program image, select the [Project] > [Download and Debug] in IAR EWARM menu (Figure 3.2.7.1).

The project image is loaded in the internal flash memory and debugging is started.

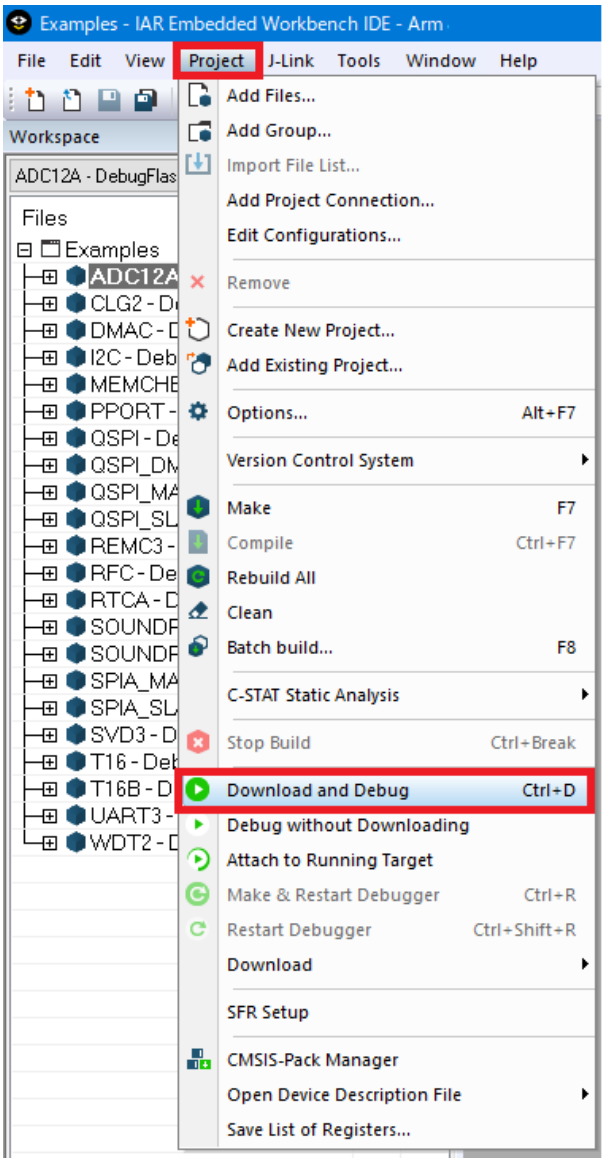

Figure 3.2.7.1 Download and Debug

3.3 Execution procedure by KEIL MDK-ARM (µVision)

3.3.1 Start MDK-ARM (µVision)

Start MDK-ARM (µVision). About details on the version of MDK-ARM used to evaluate the peripheral circuit sample software, refer to “README_j.txt” in the S1C31xxx peripheral circuit sample software package.

3.3.2 Workspace Open

The S1C31xxx Peripheral Circuit Sample Software Package provides projects for each peripheral circuit function as peripheral circuit sample software. It provides a workspace that collects projects for each peripheral circuit function.

To open the workspace, click [Project] > [Open Project…] on the uVision menu, move to the “Projects¥Examples¥WORKSPACE¥ARM” folder and select the “Examples.uvmpw” file. (Figure 3.3.2.1)

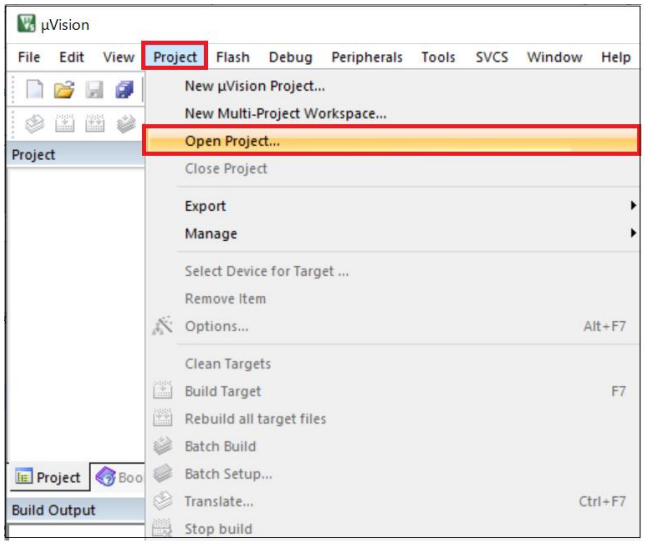

Figure 3.3.2.1 Workspace Open

3.3.3 Active Project Selecting

To build the project, select a project to be built and executed. Right-click the target project in [Project] window on µVision and select the [Set as Active Project] in right-clicked menu . Next, select the build configuration listed in the drop-down list on the tool bar of µVision (Figure 3.3.3.1).

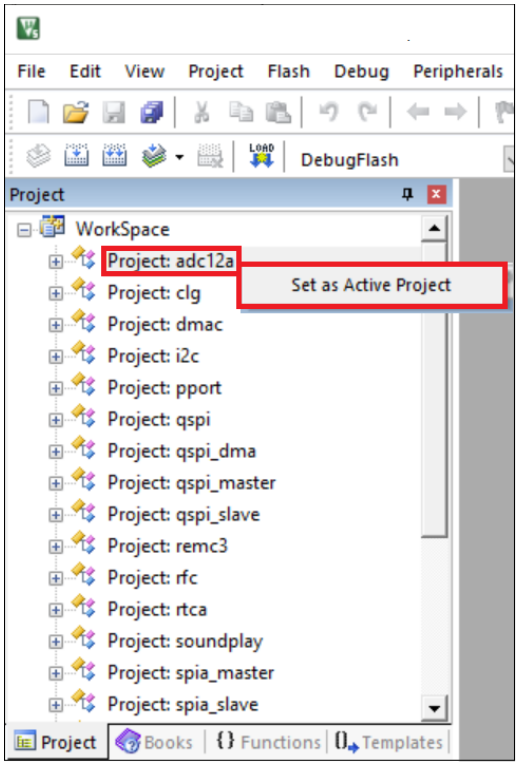

Figure 3.3.3.1 Active Project Setting

3.3.4 Debug Probe Setting

When connecting a debug probe to the evaluation board for debugging, it is necessary to set the driver according to the type of debug probe used.

To select the debug probe driver, follow the procedure below. (Figure 3.3.4.1)

(1) Select the [Project] > [Options for {project} - Target 'DebugFlash''] in the µVision menu.

(2) Switch the [Debug] tab in the [Options for Target 'DebugFlash''] dialog.

(3) Select the "J-Link/J-TRACE Cortex" from the drop-down list at the right side of [Use:] checkbox.

(4) Click the [Settings] button at the right side of the above drop-down list.

(5) Select the [SW] from the [Port:] drop-down list in the [Cortex JLink/JTrace Target Driver Setup] dialog box.

(6) Click the all [OK] button to close all dialogs.

Notes:

- This setting needs to be done with J-Link connected to the PC.
- J-Link settings are applied to each peripheral circuit function project.

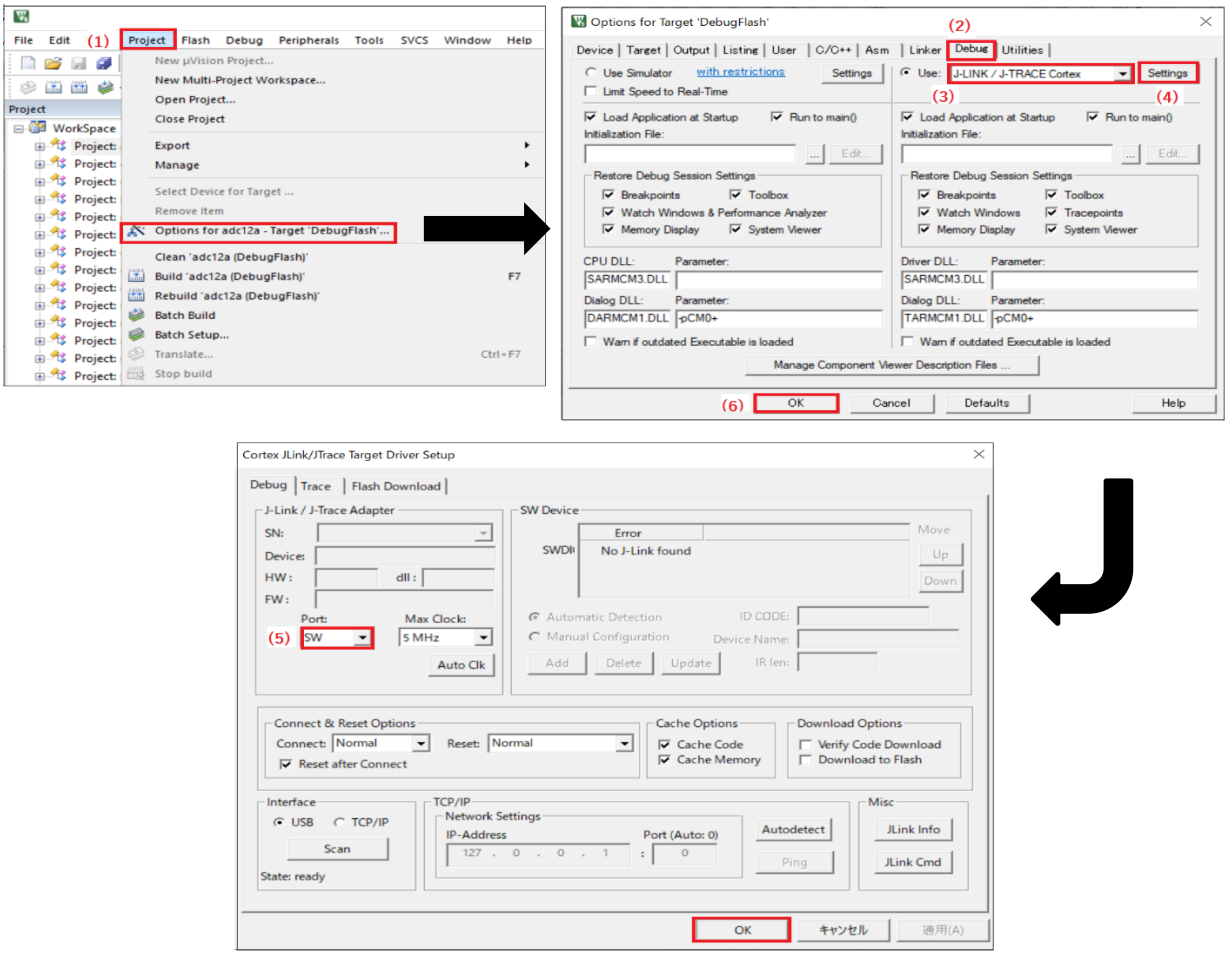

Figure 3.3.4.1 Debug Probe Selecting

3.3.5 Flash Loader Setting

Set up a flash loader to download the internal Flash memory for active projects. To set the flash loader, follow the procedure below. (Figure 3.3.5.1)

(1) Select the [Project] > [Options for {project name} - Target 'DebugFlash''] in the µVision menu.

(2) Select the [Utilities] tab in the [Options for Target 'DebugFlash'] dialog, and click the [Settings] button in the [Configure Flash Menu Command].

(3) Click the [Add] button in the [Cortex JLink / JTrace Target Driver Setup] dialog and select the flash loader "S1C31xxxint yyykB Flash" that matches the target MCU from [Add Flash Programming Algorithm].

If a flash loader other than the above is registered in [Programming Algorithm], click the [Remove] button to remove it.

(4) Enable the checkboxes, [Erase Sectors], [Program] and [Verify], in the [Download Function].

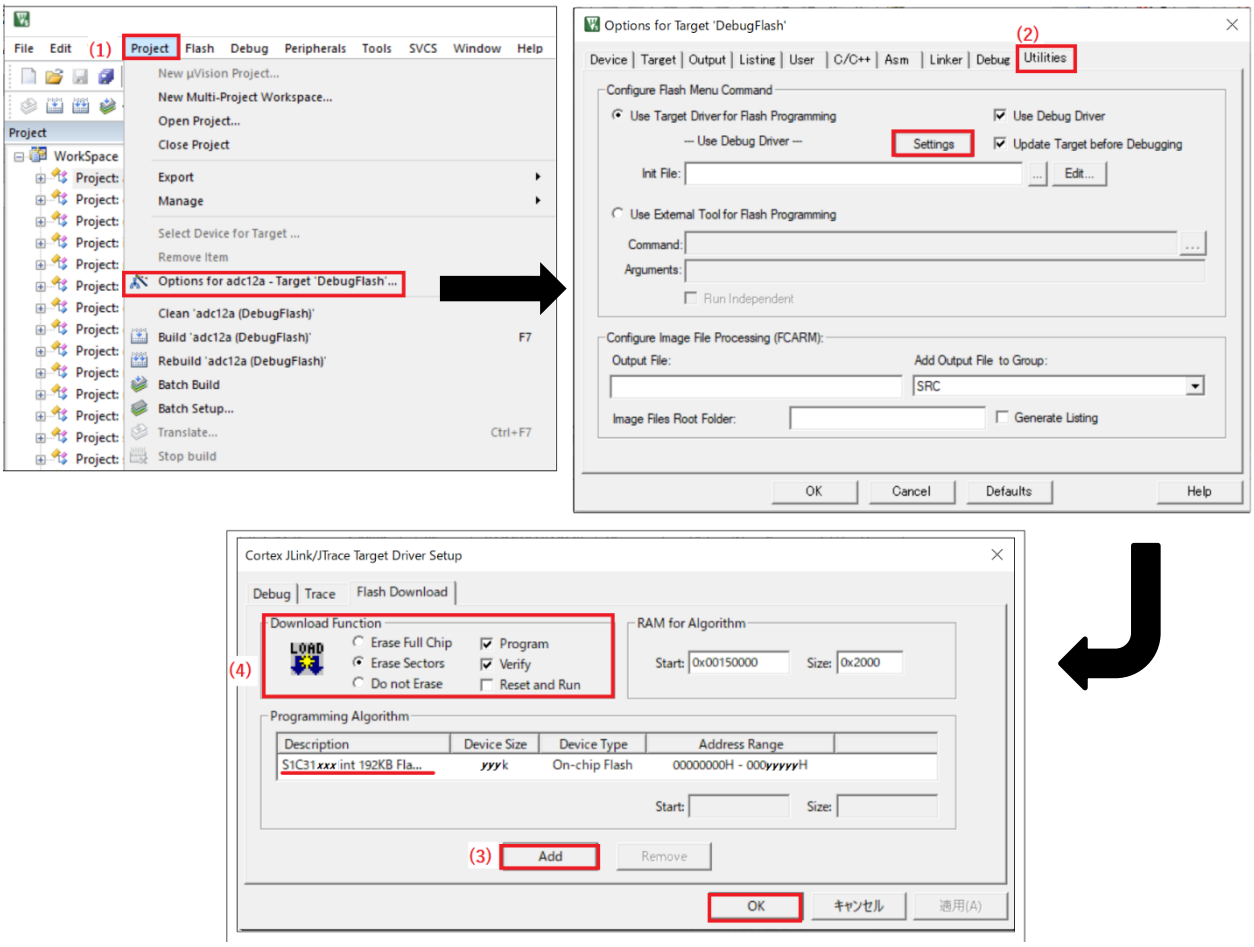

Figure 3.3.5.1 Flash Loader Setting

3.3.6 Project Build

To build an active project, select one of the build commands [Build] and [Rebuild] from the [Project] in the µVision menu (Figure 3.3.6.1).

Also, the batch build option to build the projects of all peripheral circuit function at once is available. To use the batch build option, select the [Project] > [Batch Build] in theµVision menu.

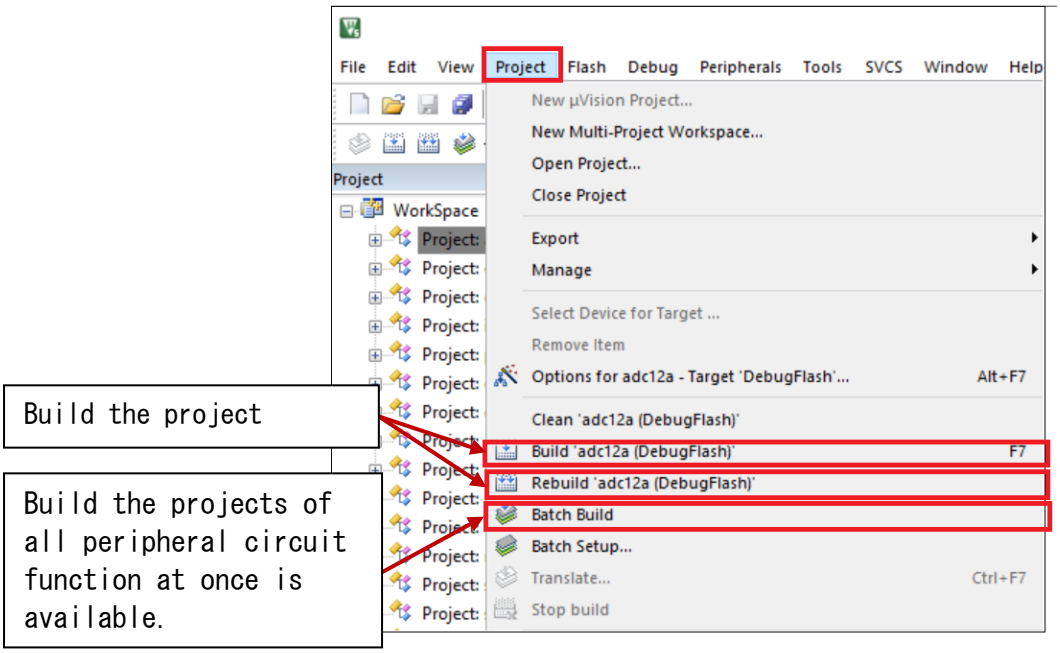

Figure 3.3.6.1 Build Commands

3.3.7 Project Download and Debug

Following a successful build, download the program image of the active project to MCU on the evaluation board. To download the program image, select the [Flash] > [Download] in µVision menu (Figure 3.3.7.1).

To start debugging, select the [Debug] > [Start/Stop Debug Session] in µVision menu (Figure 3.3.7.2).

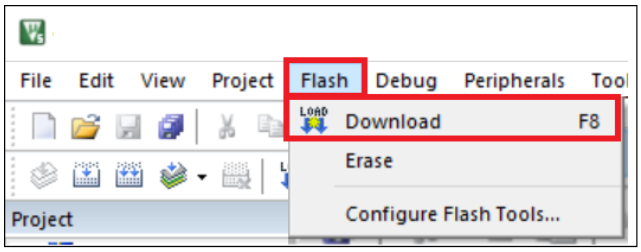

Figure 3.3.7.1 Download

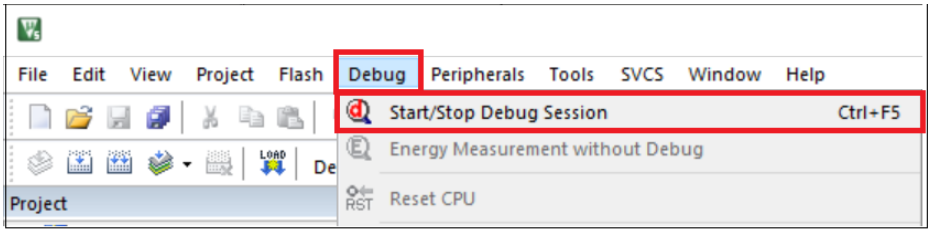

Figure 3.3.7.2 Debug

4 Peripheral circuit sample software

Each peripheral circuit sample software shows how to use the peripheral circuit functions. About an overview of each peripheral circuit sample software, refer to main.c included in the target project. About the target peripheral circuits, refer to "S1C31xxx Technical Manual".
Table 4.1 shows a list of code sizes when the peripheral circuit sample software is built with IAR EWARM or MDK-ARM.

Table 4.1 Code size of each peripheral circuit sample software

Example Project Name	IAR EWARM (Code size is 16 KB or less.)	MDK-ARM (Code size is 32 KB or less.)
ADC12A	✔	✔
CLG	✔	✔
DMAC	✔	✔
I2CLCD32BI2C	✔	✔
LCD32B	✔	✔
MCD_LPM012M134B	-	-
MDC_LPM012M134B_SERFLASH	-	-
MDC_LS012B7DH02	-	-
PPORT	✔	✔
QSPI	✔	✔
QSPI_DMA	✔	✔
QSPI_MASTER	✔	✔
QSPI_SLAVE	✔	✔
REMCn	✔	✔
RFC	✔	✔
RTCA	✔	✔
SNDA	✔	✔
SPI_MASTER	✔	✔
SPI_SLAVE	✔	✔
SVDn	✔	✔
T16	✔	✔
T16B	✔	✔
TSRVR	-	-
UARTn	✔	✔
USB_CDC	✔	✔
USB_HID	-	-
USB_MSC	-	-
WDT2	✔	✔

Note: Depending on the version of the IDE (Integrated development environment) or the build configuration of the IDE, the code size may exceed the size.

Revision History

Attachment-1

Rev. No.	Date	Page	Category	Contents
Rev.1.00	1/15/2021	All	New	New create

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