

e² studio

Integrated Development Environment

User's Manual: Quick Start Guide

RENESAS MCU RX Family, RL78 Family, RH850 Family, RISC-V MCU and DA Devices

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power is supplied until the power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.)

7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

How to Use This Manual

This manual describes the role of the e² studio integrated development environment in developing application systems and provides an outline of its features.

e² studio, which is an integrated development environment (IDE) for the Renesas device families (RX, RL78, RH850, RA, RE, RZ, RISC-V MCU, and DA), has the necessary tools for the phases (design, implementation, and debugging) of software development integrated into a single platform.

Providing an integrated environment allows all stages of development to be performed with the use of this product alone, eliminating the need to use many different tools.

Readers	This manual is intended for users who wish to use e ² studio in developing software or hardware application systems and for users of the RX, RL78, RH850, RISC-V MCU, and DA. For users of other device families, refer to the user's manuals for the individual device families.			
Purpose	This manual aims to provide users with explanations of the functions provided by e ² studio when they commence the development of hardware or software systems for use on target devices. For software packages (FIT, FSP, etc.) and code generators (Smart Configurator and FSP Configurator), refer to the individual user's guides.			
Structure	This manual can be broadly	y divided into the following sections.		
	Section 1 General Section 2 Installation Section 3 Project Genera Section 4 Build Section 5 Debug Section 6 Help	ation		
How to read this manual	It is assumed that the read- and microcontrollers.	ers of this manual have general knowledge of PCs		
Conventions	Data significance:	Higher digits on the left and lower digits on the right		
	Active low representation:	XXX (overscore over pin or signal name)		
	Note:	Footnote for item marked with Note in the text		
	Caution:	Information requiring particular attention		
	Remarks:	Supplementary information		
	Numeric representation:	Decimal XXXX Hexadecimal 0xXXXX		

Table of Contents

6.	Help	80
5.4	4.10 Memory Usage View	75
	4.9 Trace View	
	4.8 IO Registers View	
	4.7 Eventpoints View	
	4.6 Variables View	
	4.5 Disassembly View	
	4.4 Memory View	
	4.3 Registers View	
5.4	4.2 Expressions View	59
	4.1 Breakpoints View	
5.4	Basic Debugging Features	57
5.3	Launch Bar	56
5.2	Create New Debug Configurations	
5.1	Change Existing Debug Configurations	
5.	Debug	
4.3	Export Build Configuration Settings	
4.2	Build a Sample Project	
4.1	Build Option Settings	
4.	Build	
3.5	Importing SDK Projects for DA Devices	
3.4	4.2 Download and Import Sample Projects in the Smart Browser View	
3.4	4.1 Import Existing Projects	31
3.4	Importing Projects into the Workspace	31
3.3	Importing a Sample Project	
3.2	New Debug Only Project Generation	
3.1	New Project Generation	
3.	Project Generation	
2.5	Tutorial	17
2.4	Installation of Compiler Packages	
2.3	Uninstallation of the e ² studio IDE	
2.2	About 32-bit Version of e ² studio	
2.1	Installation of the e ² studio IDE (64-bit Version)	
2.	Installation	
1.5	Supported Simulators	2
1.4	Supported Emulator Devices	
1.3	Supported Toolchains	2
1.2	System Requirements	
1.1	System Configuration	1
1.	General	

1. General

e² studio is the Integrated Development Environment for Renesas embedded microcontrollers. e² studio is based on the industry-standard open-source Eclipse IDE framework and the C/C++ Development Tooling (CDT) project, covering build (editor, compiler, and linker control) and debug phases with an extended GNU Debug (GDB) interface support.

This document describes the usage of e² studio IDE to develop applications for the RX family series microcontrollers as an example.

1.1 System Configuration

Below is an example of a typical system configuration.

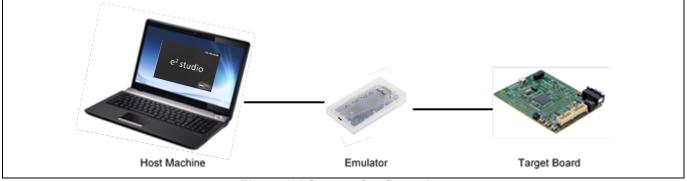


Figure 1-1 System Configuration

1.2 System Requirements

Hardware Environment:

Processor:	x64-based processor, at least 2GHz (support hyper-threading/multi-core CPU)
Main Memory:	At least 4GB, recommended 8GB of free memory space.
Hard disk Capacity:	At least 2GB of free space
Display:	Resolution at least 1,024 x 768; at least 65,536 colors
Interface:	USB 2.0 (High-speed/Full-speed). High-speed is recommended.

[Windows PC] Supported OS: Windows 10 and Windows 11 (64-bit edition) (32-bit Windows is supported with e² studio V7.8.0) Microsoft Visual C++ 2010 SP1 runtime library* Microsoft Visual C++ 2015-2022 runtime library* *: Installation of the library is at the same time as that of e² studio.

[Linux PC] Supported OS: Ubuntu 20.04 LTS Desktop (64-bit version) and later versions

[macOS PC] (Apple Silicon) macOS 13 (Ventura) and later versions



Refer to the release note for details on the supported OS versions and features of the Linux and macOS versions. Operation may not be as intended with an OS version that is not supported. Linux and macOS versions of compiler products such as CC-RX, CC-RL, and CC-RH may not be supported or may have non-supported features. In such cases, use the given compiler product in a Windows environment. For details, refer to the release note for the given compiler product.

This document is described based on the Windows version. Please refer to e² studio Release Note or FAQ page (mentioned in the Release Note) for installation in the Linux PC. Operations after installation are very similar to those on the Windows version.

1.3 Supported Toolchains

Renesas C/C++ compiler package for RX family (CC-RX) Renesas C compiler package for RL78 family (CC-RL) Renesas C compiler package for RH850 family (CC-RH) GCC for Renesas RX Toolchain LLVM and GCC for Renesas RL78 Toolchain LLVM for Renesas RISC-V MCU Toolchain

Note 1: Two types of packages (with CS+ and without IDE) for each CC-RX, CC-RL and CC-RH are available. Any of those can be applied to e² studio.

Note 2: For RH850, the e² studio can be used to debug load modules in the ELF/DWARF format which were built with the IAR Embedded Workbench from IAR Systems or the MULTI IDE from Green Hills Software.

Note 3: For DA devices, supported toolchains differ according to the SDK project. Building with GCC for Arm (including MinGW GCC) and LLVM for Arm is possible with e² studio. Check the user's manual for the SDK, register the appropriate toolchain with e² studio, and import the project. Refer to section 2.4, Installation of Compiler Packages.

1.4 Supported Emulator Devices

E2 emulator Lite (RX, RL78, RISC-V MCU)

E1 (RX, RL78, RH850) (Note 1)

E2 (RX, RL78, RH850, RISC-V MCU)

E20 (RX) (Note 2)

Segger J-Link (RX, DA, RISC-V MCU)

Note 1: The E1 emulator is EOL (end-of-life) product. Note 2: The E20 emulator does not support RH850-family MCUs with the next-generation G4MH core, such as

those of the RH850/E2x series. The E2 emulator is available for use with them.

1.5 Supported Simulators

Renesas Simulator (RX, RL78) GDB Simulator (RH850)



2. Installation

The latest e² studio IDE installer package can be downloaded from Renesas website for free. It is recommended to install the 64-bit version on 64-bit PC. The e² studio installers and related documentation are available on the e² studio product page <u>https://www.renesas.com/e2studio</u>, on the device-family information page. Note that users must log in to the Renesas account (on MyRenesas page) for the software download.

e² studio is available in 32-bit (V7.8.0 or earlier) and 64-bit (2020-04 or later). Use the 64-bit e² studio versions unless in the 32-bit OS environment.

This chapter describes the installation and uninstallation for the e² studio IDE.

Please uninstall the earlier versions before installation. Alternatively, install new e² studio into a new folder if you would like to keep earlier versions. Although upgrade installation is available, upgrading between incompatible versions is not allowed such as from V7.8.0 to 2020-04, 2024-01 to 2024-04. Please install it into a new folder if fails.

The detailed information is described below.

2.1 Installation of the e² studio IDE (64-bit Version)

1. Launch the e² studio installer. For e² studio 2023-07 and later, there are three (Lite/Standard/Custom) types of new installations. Select any of the items and click [Install].

🔜 Renesas e ² studio 2024-04 Setup		— 🗆 X
Renesas e ² studio 2024-04 Setup	RE	ΕΝΕΣΔΣ
Install Type		
Please select the e ² studio installation type. <u>Click here</u> for he	lp selecting a type and to see what fea	atures are included.
Select Install Type:		
Lite Install (Recommended) This installs e ² studio in Lite Mode. This mode offers a simplified experience focused Standard Install This installs e ² studio in Advanced Mode. This mode offers all extended debugging function		with only important features
Custom Install Custom installation of e ² studio This mode is allows you to select which features a	re installed	
<u>v202402222023</u> User: 資源統務部分	< <u>B</u> ack <u>N</u> ext >	Install Cancel

Figure 2-1 e² studio Installation – Start Page

Lite installs the minimum functionality required to build and debug your project. In addition, Standard can install extended functionality. Any function can be installed in Custom. Clicking on the **"Click here"** link displayed on the first page of the installer will show a list of the functions that will be installed by Lite and Standard, so please confirm it before proceeding.

Note: If the e² studio is already installed, the [Modify] (modifying installed e² studio) and [Uninstall] options are displayed in addition to [Install].

🔜 Renesas e² studio 2024	1-04 Setup		_	
Renesas e ² studio 2024	-04 Setup	Re		572
e2 studio version 24.4.0.R2	20240222-1907 is already installe	d.		
	What do you want to d	lo?		
		efeatures in the existing installation. enesas\e2studio202404		
	Kemove Uninstall the ex Location: C:\Re	kisting version. enesas∖e2studio202404		
	Install Install to a diffe	erent location.		
<u>v202402222023</u>	User:	< <u>B</u> ack <u>N</u> ext >	Install	Cancel

Figure 2-2 e² studio Installation – Detected Installation of e² studio



2. Welcome page

The install folder can be changed by clicking [Change...]. Click [Next] to continue.

Note1: If you would like to have multiple versions of e² studio, please specify new folder here. **Note2:** Multi-byte characters cannot be used for the e² studio installation folder name.

Renesas e ² studio 2024-04 Setu	
	RENESAS
→ Welcome	Install directory ready Install Location: C:\Renesas\e2studio202404
Device Families	[Change]
Extra Features	
Customise Features	Prerequisite software already installed
Additional Software	Internet connection available
Licenses	Change Proxy Settings
Shortcuts	<u>Change Proxy Settings</u>
Drivers	Reading to Sector II
Summary	Ready to install Software to install:
Installing	Renesas e2 studio v24.4.0.R20240222-1907
Results	Java Runtime v17.0.0 IAR Plugin Manager v1.1.0.202007251457
v202402222023 User:3	A Back Next > Install Cancel

Figure 2-3 e² studio Installation – Welcome Page

If the installer cannot access Renesas web, a warning message will appear as follows:



Unable to connect to Renesas website. Installation can continue but some functions may not be available.

Change Proxy Settings...

Figure 2-4 e² studio Installation – Website Access Warning Message

As stated in the message, <u>the installation can continue</u>. Although the software listed under "Additional Software" (such as compiler products mentioned later) are not installed, they can be installed separately after e² studio installation.



3. Device Families

Select all Device Families you will use. Click [Next] to continue.

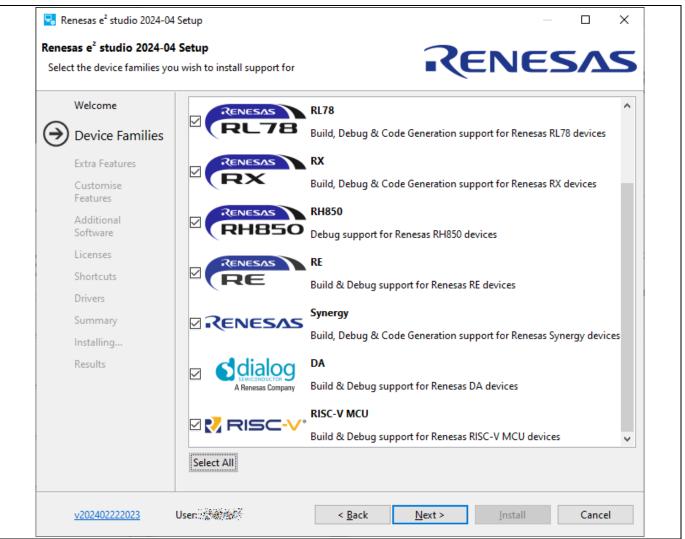


Figure 2-5 e² studio Installation – Device Families

Note: Unchecked device families will not support any build features (project creation, import and build) or debug features. Please ensure that you select the device family that you may possibly use. If you want to add a device family later, rerun the installer and choose the 'Modify' option.



4. Extra Features

This dialog is skipped in Lite/Standard installation type. Select Extra Features (i.e. Language packs, Git support, RTOS support...) to install.

For the non-English language menu, please select Language packs at this step.

Click [Next] to continue.

🗟 Renesas e ² studio 2024-04	4 Setup		— D X
Renesas e ² studio 2024-04 Setup Select the extra features you wish to install			RENESAS
Welcome Device Families			Japanese Language Support
Extra Features			Chinese (Simplified) Language Support
Customise Features Additional Software			Chinese (Traditional) Language Support
Licenses Shortcuts			Git Integration Git SCM Support
Drivers Summary Installing		P	Terminals ANSI/vt102 compatible Terminal support for Serial, ssh and Telnet
Results	Select A	AII	
<u>v202402222023</u>	User:	ing i	< <u>B</u> ack <u>N</u> ext > <u>Install</u> Cancel

Figure 2-6 e² studio Installation – Extra Features



5. Customize Features

This dialog is also skipped in Lite/Standard installation type. Select the components to install and click the [Next] button to continue.

号 R	enesas e ² studio 2024-	-04 Setup — — >	×
Rene	sas e ^² studio 2024-		5
	Welcome	Select the components you want to install.	
		Renesas e2 studio (24.4.0.R20240222-1907)	^
	Device Families	🕁 🕢 Java Runtime (17.0.0)	
	Extra Features	OpenJDK & OpenJFX	
(\mathbf{P})	Customise Features	IAR Plugin Manager (1.1.0.202007251457) IAR Plugin Manager simplifies installation of IAR compiler and debugger plugins.	
	Additional		
	Software		
	Shortcuts		
	Drivers	Renesas e2 studio Common Components for RISC-V Devices (24.4.0.R20240222-1907)	~
	Summary	Select All Optional Deselect All Optional	
	Installing		
	Results	Size of install: 1.3 GB Temporary space required: 2.5 Available: 13.4 GB	GB
	<u>v202402222023</u>	User: 🐨 Kancel Cancel	

Figure 2-7 e² studio Installation – Customize Features



e² studio

6. Additional Software

Select additional software (i.e. compilers, utilities, QE...) and click [Next] to continue.

Note: If no Internet access is available, additional software <u>installation can be skipped</u> because software catalog cannot be downloaded. The additional software can be installed later.

Selec	t the additional softw	vare y	ou wisł	n to install	NE	2/7	
	Welcome		>	Renesas QE			^
	Device Families		∼	Renesas Al			
					23.10.0		
	Extra Features			,	23.10.0		
	Customise				23.10.0		
	Features				1.2.0		
_			• •	Renesas Toolchains && Utilities			
\bigcirc	Additional				v2.08.01	1000 B	
Ó	Software				v3.06.00	23.6 MB	
	Licenses				v1.13.00	20.3 MB	
	LICENSES				v2.06.00	1000 B	
	Shortcuts				v1.02.00	1000 B	
	Drivers				v1.00.00	1000 B	
			 Image: Image: Ima	GCC Toolchains && Utilities			
	Summary				8.3.0.202311	1000 B	
	Installing				4.9.2.202201	1000 B	
	2				10.0.0.202312	1000 B	
	Results				13.2.1.arm-13-7		
					12.2.1.arm-12-24	1000 B	
					10.3.0.202110	1000 B	
				GCC ARM A-Profile (AArch64 bare-metal) 10.3 2021.07		1000 B	
					17.0.1	937.8 MB	
					17.0.2.202401	1000 B	
				LibGen for GNU ARM Embedded	1.2023.11	8.8 MB	\sim
					1.3 GB do	ownload req	uired

Figure 2-8 e² studio Installation – Additional Software



7. License Agreement

Read and accept the software license agreement. Click the [Next] button. Please note that users must accept the license agreement, otherwise installation cannot be continued.

Renesas e ² studio 2024 Welcome	Please read and accept the following Software Agreements
Device Families Extra Features Customise Features Additional Software Licenses Shortcuts Drivers Summary	Renesas e2 studio OpenJDK License Agreem ARM DS-5 Toolchain Inter IAR Plugin Manager Renesas FSP v5.1.0 License Terms and Conditions for RENESAS e2 studio This Renesas e2 studio license agreement ("Agreement") is between the entity on whose behalf you are entering into this Agreement ("Client") and Renesas Electronics Corporation, a Japanese company with its registered office at 3-2-24, Toyosu, Koto-ku, Tokyo 135-0061, Japan ("Renesas"). YOU SHOULD READ THIS AGREEMENT CAREFULLY, AS IT CONSTITUTES A BINDING CONTRACT BETWEEN CLIENT AND RENESAS. The Renesas IDE Software (defined below) is intended for commercial use by a company or corporation only and is not designed, developed or produced for any private use or purpose. If you are an individual, or you intend to install the Renesas IDE Software on behalf of an individual, or the Renesas IDE Software is expected to be used for a private purpose directly or indirectly, you should click "No" on the installer. Otherwise, by clicking the "I accept" button or other button or
Installing Results	✓ I accept the terms of the Software Agreements Print all

Figure 2-9 e² studio Installation – Licenses

You can also check the contents displayed here after installation. You can read them by clicking the icon in "About e² studio" under the e² studio "Help" menu and select the License button, or by opening "Features" tab in "Installation Details".



e² studio

8. Shortcuts

Select shortcut name (not mandatory) for start menu and click the [Next] button to continue.

Note: If e^2 studio was installed in another location, it is recommended to rename to distinguish from the other e^2 studio(s).

🗟 Renesa	as e² studio 2024-0	4 Setup				_		Х
Renesas e	² studio 2024-0	4 Setup		Re	ENE	ES	SA	S
Wel	lcome	Shortcuts to important pro	grams and files v	vill be created in the f	following loca	tions:		
	rice Families ra Features	🗹 In start menu group:	Renesas Electro	nics e2 studio				
	tomise tures					<u>€</u> <u>R</u> €	estore De	efault
	ditional tware							
Lice	enses							
→ She	ortcuts							
Driv	/ers							
Sum	nmary							
Insta	alling							
Resu	ults							
<u>v202</u>	2402222023	User:	< <u>B</u> ack	<u>N</u> ext >	<u>I</u> nstall		Cance	:1

Figure 2-10 e² studio Installation – Shortcuts



9. Drivers

This dialog asks whether to install the debugger driver. Do not install drivers if you have previously installed the same version of the e² studio.

Renesas e² studio 2024-	04 Setup — 🗆 🗙
Renesas e ² studio 2024-(
Welcome Device Families Extra Features Customise Features Additional Software Licenses Shortcuts Orivers Summary Installing Results	Do you want to install debugger drivers? () Install drivers (you will be prompted for administrator permissions) () Do not install drivers
<u>v202402222023</u>	User: Mack Next > Install Cancel

Figure 2-11 e² studio Installation – Drivers



10. Summary

A list of components to be installed is shown. Please confirm the contents and click the [Install] button to install the e² studio IDE.

Renesas e ² studio 2024	-04 Setup			_	
			NESA	>	
Welcome	Ready to install			^	
Device Families	Software to install:				
Extra Features		v24.4.0.R20240222-1907			
	Java Runtime v17.	0.0 er v1.1.0.202007251457			
Customise		Common Components (Lite) vi	24 4 0 R20240222-1907		
Features		Common Components (Full) v			
Additional		Common Components for ARN			
Software	v24.4.0.R20240222-190	7			
		Common Components for RISC	C-V Devices		
Licenses	v24.4.0.R20240222-190				
Shortcuts		Tools v24.4.0.R20240222-1907	17		
.		Support v24.4.0.R20240222-190 Support v24.4.0.R20240222-190			
Drivers		Support (requiring .Net Frame			
\bigcirc	1907		,		
Summary		ily Support v24.4.0.R20240222-1			
		ily Support (requiring .Net Fram	ework) v24.4.0.R20240222-		
Installing	1907		-		
Results		Renesas RX Family Support v24.4.0.R20240222-1907 Renesas RX Family Support (requiring Net Framework) v24.4.0.R20240222-			

Figure 2-12 e² studio Installation – Summary

11. Installing...

The installation is in progress. Based on selected items of Additional Software, new dialogs are opened to proceed with the software installation.



12. Results

Installation results are listed here. Please note if any errors are shown.

Click the [OK] button to complete the installation.

Renesas e ² studio 202	4-04 Setup	RENESAS		
Welcome Device Families Extra Features Customise Features Additional Software Licenses Shortcuts Drivers Summary Installing	Installation of e2 studio is complete. Please click OK to close. Launch e2 studio? View Release Notes? View What's New?			
<u>v202402222023</u>	User. Back	Next > OK Cancel		

Figure 2-13 e² studio Installation – Results

Note: If you have installed as a different account than the one you normally use such as for administrator privileges, do not start the e² studio by checking "Launch e2 studio?" in this dialog. If you do so, discard the workspace that was used at that time.

2.2 About 32-bit Version of e² studio

There is no Lite/Standard selection for e² studio V7.8.0 or earlier installers.

The installer's interface follows a similar flow to that of the 64-bit version, although the displayed content may vary slightly. Therefore, refer to the above explanation when using it.

For users of the 32-bit OS environment in which 64-bit versions of e^2 studio do not work, e^2 studio V7.8.0 is available on the e^2 studio product page. Unless there is a specific requirement for this version, it is recommended to use the 64-bit versions (202x-xx).



2.3 Uninstallation of the e² studio IDE

By Windows OS, you can uninstall programs by selecting "e² studio" from the list of installed programs in [Start] \rightarrow [Control Panel] \rightarrow [Apps & features]. However, if uninstallation is not possible, run the uninstaller directly from the following folder:

```
{e<sup>2</sup> studio installed folder}/uninstall/uninstall.exe.
```

If this still doesn't work, remove it using the same version of the e² studio installer, or just delete the destination folder.

2.4 Installation of Compiler Packages

As mentioned above in installation procedure, compiler packages can be installed with e² studio when you have access to the Internet. Please install compiler packages separately from e² studio installation when Internet access is not available.

Compiler packages are found in the following websites. Please read descriptions on the websites for installation procedures.

Renesas Compiler for RX : <u>http://www.renesas.com/rx_c</u>

Renesas Compiler for RL78 : <u>http://www.renesas.com/rl78_c</u>

Renesas Compiler for RH850 : <u>http://www.renesas.com/rh850_c</u>

LLVM and GNU toolchain for RL78 : https://llvm-gcc-renesas.com/rl78-download-toolchains/

GCC for Renesas RX toolchain: https://llvm-gcc-renesas.com/rx-download-toolchains/

LLVM for Renesas RISC-V MCU toolchain : https://llvm-gcc-renesas.com/riscv-download-toolchains/



e² studio

Open "Renesas Toolchain Management" dialog ([Help] menu -> [Add Renesas Toolchains]) to confirm which toolchains are installed and integrated. The checked toolchains are integrated into e² studio. Click the [Add] button to add a new toolchain installed path if it is not found in this list.

type filter text	Renesas Toolchain Management	
> General		ν ν 0
> C/C++	Scan for installed toolchains on startup	
> Help	Toolchain Type	Installation Path
> IAR Embedded Workbench	> GNU ARM Embedded	
> MCU	GCC ARM A-Profile (AArch64 bare-metal)	
> Oomph	✓ ✓ LLVM for RL78	
> Remote Development	10.0.0.202303	C:\GNU_Tools\LLVM for Renesas RL78 10.0.0.202303\
✓ Renesas	✓ ✓ Renesas CC-RH	
Breakpoints	✓ v2.05.00	C:\Program Files (x86)\Renesas\RH\2_5_0\
Device add-ins Support	> 🗹 KPIT GNUARM-NONE-EABI Toolchain	
> FSP	xPack GNU ARM Embedded	
Launch Settings	✓ ■ Renesas CC-RL	
Logging	✓ v1.12.00	C:\CS+\CS+\CC\CC-RL\V1.12.00\
Reality Al Authentication	Renesas CC-RX	
Renesas QE	> GCC for Renesas RX	
Renesas Toolchain Mana	✓	
Smart Browser	✓ v1.00.00	C:\Renesas\SMS\
 Smart Configurator XML 	> 🗹 GCC for Renesas RL78	
	Download	Scan Add Remove
< >>	<	>
? 🗠 🗹		Apply and Close Cancel

Figure 2-14 Renesas Toolchain Management

You can also click the [Download] button to install a new toolchain when you have Internet connection.



2.5 Tutorial

The following chapters will explain the process of creating a project to start the debugger. Additionally, you will also find a tutorial for each type of Device Family and toolchain (compilers) in the e² studio Help. Note: Tutorials are available for the supported Device Families that you selected during installation.

Help - e ² studio
Search: Go Scope: All topics
Contents 😻 👜 🗸 🕅 🔄 🗉
🗄 🍩 Eclipse Platform User Guide
🗄 🧇 C/C++ Development User Guide
🖻 🗐 e2 studio User Guide
🖻 🕮 General
🗎 e2 studio Plug-in list
🗉 💷 Renesas RL78 Simulator
🗄 💷 Code Generator
🗉 💷 Integration Service
e2 studio Synchronise workspace with file system
Renesas Software Installer
🗉 💷 Renesas Region specific devices
🗉 🖼 Frequently Asked Questions
T Import/Export
🗉 💷 Tutorials
🗉 💴 GCC for Renesas RZ Tutorial
🗉 🖼 LLVM for Renesas RL78 Tutorial
🗉 💷 Renesas C compiler package for RL78 family Tutorial
🗉 💴 GCC for Renesas RL78 Tutorial
🗉 🍱 GCC for Renesas RX Tutorial
Renesas C/C++ compiler package for RH family Tutorial
Renesas C/C++ compiler package for RX family Tutorial
E E Building Projects
Debugging Projects
Eclipse Marketplace User Guide
Eclipse Remote Developer's Guide

Figure 2-15 Tutorial



3. Project Generation

In e² studio, "Project" is a basic unit to perform build and debug operations.

This chapter describes the creation of a new project and import of an existing e² studio project, the Highperformance Embedded Workshop IDE (described as "HEW" below) project and the CS+ project to the e² studio IDE.

Note: 1. To install and use the e² studio on your PC, you must install the compiler package provided separately.

2. Multi-byte characters cannot be used for the e² studio installation folder name, project name and its folder, and source file name.

3.1 New Project Generation

To create a new project, invoke the e² studio IDE from Windows ([Start] menu) and specify a workspace directory. To create a new project, proceed as follows:

Note: For DA devices, do not create a new project but import a project by following section 3.5, Importing SDK Projects for DA Devices.

1. Click [File] \rightarrow [New] \rightarrow [C/C++ Project] to open a new project creation wizard.

C \	workspace - e² studio		
<u>F</u> ile	<u>E</u> dit <u>S</u> ource Refactor <u>N</u> avigate	Se <u>a</u> rch <u>P</u> roject Re	nesas <u>V</u> iews <u>R</u> un <u>W</u> indow <u>H</u> elp
	New	Alt+Shift+N >	Renesas C/C++ Project >
	Open File		🖻 Makefile Project with Existing Code
_	Open Projects from File System		C/C++ Project
	Recent Files	>	📫 Project
	Close Editor	Ctrl+W	Convert to a C/C++ Project (Adds C/C++ Nature)
	Close All Editors	Ctrl+Shift+W	😂 Source Folder
			😂 Folder
	Save	Ctrl+S	C Source File
	Save As		🖻 Header File
B	Save All	Ctrl+Shift+S	🗅 File from Template
	Revert		© Class
	Move		Code Generator
2	Rename	F2	🗅 Other Ctrl+N

Figure 3-1 Open New Project Creation Wizard



 Select a template for the new project (e.g., Renesas RX: "Renesas CC-RX C/C++ Executable Project"). If the target device family or the toolchain were not listed, you may need to run the e² studio installer to add "Build/Debug support plugins" for the target device family. Click [Next] to proceed.

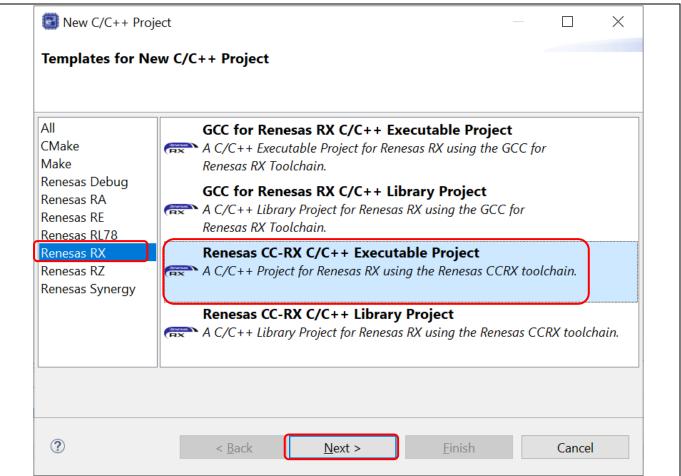


Figure 3-2 New Project Creation Wizard (1/6)



3. Enter the project name. Click [Next] to proceed.

8	—) X
New Renesas CC	-RX Executable Project		-
New Renesas CC-R	X Executable Project		
<u>P</u> roject name: Tute	oria		
✓ Use <u>d</u> efault local	ation		
Location:	C:\Users\Renesas\e2_studio\workspace\Tutorial	B <u>r</u> o	wse
Choose file system	Create Directory for Project		
Working sets			
Add projec <u>t</u> to	working sets	Ne	<u>w</u>
W <u>o</u> rking sets:	\sim	S <u>e</u> le	ect
?	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish	Ca	ncel

Figure 3-3 New Project Creation Wizard (2/6)



 Select Language, Toolchain, Toolchain Version, RTOS, RTOS Version, Target Board, Target Device and Configurations. Click [Next] to proceed.

Notes:

- "E1" or "E2" can be selected in the same way as E2 Lite in the Hardware Debug Configuration pull down menu.
- Please select "C++" as Language when you use C++ source files in the project.

Select toolchain, de	evice _debug settings	
Toolchain Settings		
Language:	● C ○ C++	
Toolchain:	Renesas CCRX ~	
Toolchain Version:	v3.03.00 ~	
	Manage Toolchains	
RTOS:	None ~	
RTOS Version:	~	
		Canfigurations
Device Settings		Configurations
	II.	Configurations
	II.	
Target Board: Cus	stom ~ Download additional boards	Create Hardware Debug Configuration
Target Board: Cus	stom ~ Download additional boards	Create Hardware Debug Configuration
Target Board: Cus	stom <u>Download additional boards</u> 51101AxLM Unlock Devices	 Create Hardware Debug Configuration E2 Lite (RX) Create Debug Configuration RX Simulator
Target Device: R5F	stom <u>Download additional boards</u> 51101AxLM <u>Unlock Devices</u> e	 Create Hardware Debug Configuration E2 Lite (RX) Create Debug Configuration
Target Board: Cus Target Device: R5F Endian: Littl	stom <u>Download additional boards</u> 51101AxLM <u>Unlock Devices</u> e	 Create Hardware Debug Configuration E2 Lite (RX) Create Debug Configuration RX Simulator
Target Board: Cus Target Device: R5F Endian: Littl	stom <u>Download additional boards</u> 51101AxLM <u>Unlock Devices</u> e	 Create Hardware Debug Configuration E2 Lite (RX) Create Debug Configuration RX Simulator

Figure 3-4 New Project Creation Wizard (3/6)

- 5. Coding Assistant feature can be applied if necessary. Click [Next] to proceed.
 - *Peripheral Code Generator* (CG) supports the generation of driver and peripheral function code based on GUI settings. Functions are provided as APIs and are not limited to initialization of peripheral function.
 - *FIT* provides drivers and codes in the higher layer than CG, such as communication protocol stacks and sample application programs using peripheral functions. All FIT modules are interchangeable because they are implemented with common interfaces.
 - Smart Configurator supports a single user interface that combines the functionalities of Code Generator and FIT Configurator. Smart Configurator encompasses unified clock configuration view, interrupt configuration view and pin configuration view.

Note: Peripheral Code Generator and Smart Configurator may not be available for some devices.

	 -		×
New Renesas CC-RX Executable Project			>
Select Coding Assistant settings		1	
Use Smart Configurator			
Use Peripheral Code Generator [®]			
Use FIT Configurator			
Download FIT Modules			
? < Back Next > Finish		Canaal	
? < <u>Back</u> <u>N</u> ext > <u>Finish</u>		Cancel	

Figure 3-5 New Project Creation Wizard (4/6)



6. Keep "Use Renesas Debug Virtual Console" unchecked and click [Next] to proceed.

New Renesas CC-RX Executable Project		
Settings The Contents of Files to be Generated		
What kind of initialization routine would you like to create?		
Use Renesas Debug Virtual Console Size of I/O Stream Buffer:		
3		
? < <u>B</u> ack <u>N</u> ext > <u>F</u> inish	1	Cancel

Figure 3-6 New Project Creation Wizard (5/6)



7. A project summary is displayed. Click [Finish] to generate the project.

6					\Box ×
lew Renesas CC-RX Executable Project					\bigcirc
Toolchain Name :	Renesas CCRX				^
TOOLCHAIN VERSION :	v3.02.00				
					•
			F		
?	< <u>B</u> ack	<u>N</u> ext >	<u>E</u> inish		Cancel

Figure 3-7 New Project Creation Wizard (6/6)





🔹 🐲 🔳 🏘 Debug 🛛 🗸 🖻 Tutorial Hardwa	reDebu 🗸 🏟 🛝 🔻 🐐 🗰 🎟 😭 💱 🕹 🗇 🕸 😭 🗂 🖛 🔛 🗞 💌 📾 🖝 😂 🔻	C ▼ S ▼ S ▼ S ▼ S ▼ S ▼ S ▼ S ▼ S ▼	1 T
		९ 🛛 🖻 🖻 C/C++ 🌣 Debug 🦨 Smart Configurator 🕸 FSP Con	figuratio
Project Explorer 🕮 🔲 😫 🍞 🕴	• •	□ 🗄 Outline 🛛	8 -
 Tutorial Tutorial Includes Includes Indress Introp.c Introp.com/Intrenter/Introp.c<th></th><th>There is no active editor that provoutline.</th><th>rides an</th>		There is no active editor that provoutline.	rides an
	🗈 Problems 🕮 🗳 Console 👒 Smart Browser 🤑 Smart Manual		78 -
	0 items	A	
	Description		
	<		
	0 items selected	Polling context help: (55%)	-

Figure 3-8 New C Project Created

This project consists of an application file "Tutorial.c" and standard start-up files (e.g. "dbsct.c", "intprg.c", "sbrk.c", etc.). All these projects and source files listed in the [Project Explorer] panel reflect the folder structure of the project, just as seen on the standard file explorer.

Notes on backing up projects:

- Project properties are stored in files or folders of which filenames or folder names are prefixed with a '.' (dot), for example ".project" and ".cproject". It is necessary to include these files or folders when archiving the project for back-up purposes.
- In order to restore properties shared among projects, for instance when one project makes reference to another project's files, please back up the whole workspace folder.



3.2 New Debug Only Project Generation

Creating a debug only project allows users to debug an existing executable file that users have already built. This feature will automatically create a project and debug configuration for users.

Note: The e² studio can be used to debug load modules in the ELF/DWARF format which were built with the IAR Embedded Workbench from IAR Systems or the MULTI IDE from Green Hills Software.

To create a debug only project,

1. Click [File] \rightarrow [New] \rightarrow [C/C++ Project] to open a new project creation wizard.

C v	vorkspace - e² studio				
<u>F</u> ile	<u>E</u> dit <u>S</u> ource Refactor <u>N</u> avigate	Se <u>a</u> rch <u>P</u> roject R	enes	as <u>V</u> iews <u>R</u> un <u>W</u> indow <u>H</u> elp	
ſ	New	Alt+Shift+N >		Renesas C/C++ Project	> 5
	Open File		B	Makefile Project with Existing Code	
	Open Projects from File System		Ċ	C/C++ Project	
	Recent Files	>		Project	
	Close Editor	Ctrl+W	C++	Convert to a C/C++ Project (Adds C/C++ Nature)	
	Close All Editors	Ctrl+Shift+W	Source Folder		
		culus.		Folder	
	Save	Ctrl+S	C	Source File	
	Save As		h	Header File	
	Save All	Ctrl+Shift+S	P	File from Template	
	Revert		¢	Class	
	Move		<u></u>	Code Generator	
2	Rename	F2		Other	Ctrl+N

Figure 3-9 Open New Project Creation Wizard

2. Select a template for the new project: [Renesas Debug] → [Renesas Debug Only Project]. Click [Next] to proceed.

📴 New C/C++ Proj	ect	-		×
Templates for Ne	ew C/C++ Project			
All CMake	Renesas Debug Only Project Renesas Debug Only Project		 	
Make	Nenesus Debug only Hojeet			
<mark>Renesas Debug</mark> Renesas RA				
Renesas RE Renesas RL78				
Renesas RX				
Renesas RZ				
Renesas Synergy				
?	< Back Next >	Einish	Cancel	
\odot			Cancer	

Figure 3-10 Specify the Project Template



3. Enter the project name. Click [Next] to proceed.

•	_	
Debug Only		
Create a Debug Or	nly project	
<u>P</u> roject name: Deb	pugOnly_Tutorial	
✓ Use <u>d</u> efault loc	ation	
Location:	C:\Users\Renesas\e2_studio\workspace\DebugOnly_Tutorial	B <u>r</u> owse
	Create Directory for Project	
Choose file s <u>y</u> stem	default 🗠	
Working sets		
Add projec <u>t</u> to	working sets	Ne <u>w</u>
W <u>o</u> rking sets:	~	S <u>e</u> lect
?	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish	Cancel

Figure 3-11 Specify Project Name



4. Select the debug hardware (e.g. "E2 (RH850)") and target device (e.g. R7F701007xAFP). Note that these settings should be consistent with the settings to build the executable file. Then specify the location of prebuilt executable file (i.e. executable file built in other IDEs) which <u>should be built as ELF/DWARF format</u> to be recognized by the debugger. Click [Finish] to create the project.

8	— 🗆 X
Debug Only Debug Only Project	
Debug Hardware Hardware E2 (RH850) Simulator 	Device Settings Target Device: R7F701007xAFP <u>Unlock Devices</u> Endian: Little ~
Device Executable Executable Path: CS+\RH850_F1L_Tutorial_Analys	sis\DefaultBuild\RH850_F1L_Tutorial_Analysis.abs
? < <u>B</u> ack 1	<u>√</u> ext > <u>F</u> inish Cancel

Figure 3-12 Specify Project Settings



5. The project named "DebugOnly_Tutorial" is created. User can only modify the debug configuration of this project and start debugging.

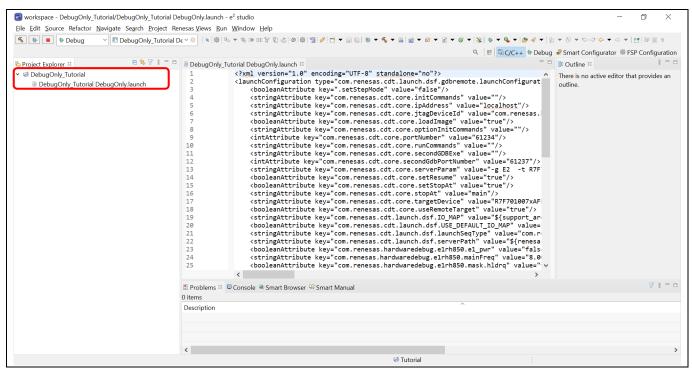


Figure 3-13 Debug Only Project is Created



3.3 Importing a Sample Project

e² studio can search and import sample projects on the Renesas website.

Open the "File" menu and select "Import..." to launch Import Wizard. Then select "Sample Project on Renesas Website".

ARM Embedded

Figure 3-14 Sample Project Import

Select the target device family in the Online or Local category, then select a device. Sample projects will be listed for the device. Click [Finish] to import the selected project. <u>If the project does not appear on this dialog due to PC or networking limitations</u>, refer to the alternative method mentioned in the following chapter.

🖸 Import			_		×	
	ject on Renesas website arch, download and import its samp	le projects				
> Local Online Dialog EC-1 RA RE RH850 RL78 RX RZ Synergy	Device: R5F566TF Sample projects: type filter text RX Family RX Driver Package RX66T Group Sensorless vector RX66T Group Initial Settings E RX66T Sensorless vector contr RX66T Vector control for perm RX66T Renesas Starter Kit Sam C Description: RX66T Group Initial Settings Exam	or control for dual p xample Rev.1.10 rol for permanent n nanent magnetic sy uple Code (e2 studio	nagnetic synchronou nchronous motor wi	synchrono is motor (l ith encode	Im	
?	< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish	Cance	I	

Figure 3-15 Sample Projects of the Target Device



3.4 Importing Projects into the Workspace

The migration guideline between integrated development environments (i.e. import CS+/HEW projects to e² studio, or export to CS+) can be found at the following site.

https://www.renesas.com/us/en/software-tool/migration-tools-ide

3.4.1 Import Existing Projects

To import an existing e² studio project to a current workspace, please follow instructions below. These steps import a sample project from the Renesas website to use for demonstrating debugging features in section 5.

1. Download the sample code for RX64M by searching for "RX64M Renesas Starter Kit Sample Code for e² studio" from the Renesas website: <u>https://www.renesas.com/en/support/document-search</u>.

	IS DESIGN & SUPPORT BUY & SAMPLE ABOUT
Design & Support > Search	
Search	
Found 65 results	Filter by Type
RX64M Renesas Starter Kit Sample Code for e2 studio	
Search tips: use quotes to search for specific strings (e.g. "wireless (e.g. wireless power +receiver, or power -wireless)	s power") and require/exclude terms with +/- Story (2)
SEARCH >	Document Type Filter
Sort by Relevancy V Order Desc V	Application Note (45) Brochure (6) Flyer (1)
RX64M Renesas Starter Kit Sample Code fo	Manual (1) Release Note (2)
Sample Code - (6.99 MB ZIP)	Sample Code (2)
Document - Mar 18, 2015	Software Type Filter
RX64M Renesas Starter Kit Sample Code fo	pr e2 studio
RENESAS	Smart 🗸 Search 🔍 🌐 🥁 📑 🚨 LOG OUT
BIG IDEAS FOR EVERY SPACE	
PRODUCTS APPLICATIONS	S DESIGN & SUPPORT BUY & SAMPLE ABOUT
RX64M Renesas Starter Kit	Sample Code for e2 studio
	anism designed to acknowledge agreement "Agreement"), or by downloading, installing, f the licensed software described in the

Figure 3-16 Download the Sample Code



2. "Tutorial" project is included in the download file.

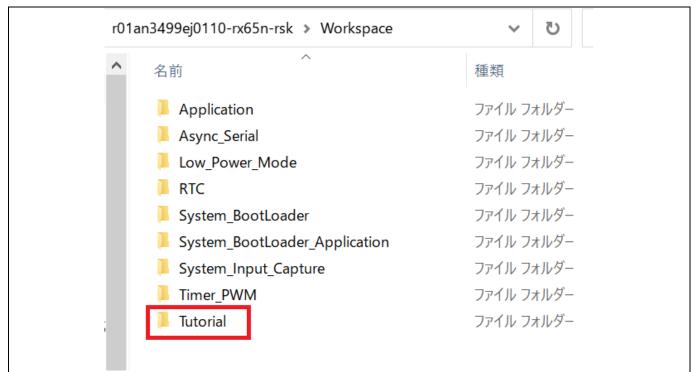


Figure 3-17 Downloaded File Contents



3. In e² studio, select [File] \rightarrow [Import].

File	Edit	Source	Refactor	Navigate	Search	Project
	New				Alt+Sh	ift+N >
	Open	File				
	Open	Projects f	from File Sy	/stem		
	Recer	nt Files				>
	Close	Editor			C	trl+W
	Close	All Editor	'S		Ctrl+Shi	ift+W
è	Impo	rt				
4	Expo	t				
	Prope	erties			Alt+	Enter

Figure 3-18 Import the Sample Project

4. In the [Import] dialog, select [General] → [Existing Projects into Workspace]. Click [Next].

🔄 Import				\times
Select Create new p	ojects from an archive file or directory.			Ľ
<u>S</u> elect an imp	ort wizard:			
type filter te	t			
G CM: G CM: G Exis G File G File G Pref G Pref	ive File IS Pack IS Pack ing Projects into Workspace			~
?	< <u>B</u> ack <u>N</u> ext >	<u>F</u> inish	Cance	ł

Figure 3-19 Select Import Wizard

5. In the [Import Projects] dialog, select "Select archive file". Click [Browse] then select the downloaded zip file.

🔄 Import				
Import Projects				
Select a directory to se	arch for existing Eclip	ose projects.		
Select roo <u>t</u> directory	:		~	B <u>r</u> owse
Select <u>a</u> rchive file:				B <u>r</u> owse
Projects:				
				<u>S</u> elect All
				<u>D</u> eselect All
				R <u>e</u> fresh
Options Search for nested p Copy projects into Close newly import Hide projects that a Working sets	workspace ed projects upon co			
Add projec <u>t</u> to wo	rking sets			Ne <u>w</u>
W <u>o</u> rking sets:				S <u>e</u> lect
?			_	

Figure 3-20 Select Project Location to Import



6. The project "Tutorial" will be listed in "Projects". Check "Tutorial" then click [Finish].

📴 Import						\times
Import Projects						
Select a directory to sea	rch for existing Ecli	pse projects.				
					Duraura	
Select root directory:					B <u>r</u> owse	
Select <u>archive</u> file:	N_an_r01an2218	eg0100_rx64m_rsk_9	CD_20150318.zip	~	Browse	e
<u>P</u> rojects:						
	-	sk/Workspace/RTC/)		^	<u>S</u> elect	All
· · · · ·		8eg0100_rx64m_rsk		r 🔤	<u>D</u> eselec	t All
		rx64m_rsk/Workspa m_rsk/Workspace/Tu			R <u>e</u> fres	h
	12210cg0100_1x04		>		<u>ne</u> nes	
Options ✓ Search for nested pr ✓ Copy projects into v ✓ Close newly imported Hide projects that all	vorkspace ed projects upon co					
Working sets						
Add projec <u>t</u> to wor	king sets				Ne <u>w</u>	
Working sets:				~	S <u>e</u> lect	

Figure 3-21 Complete Project Import



7. Right-click on the imported project and select "Upgrade Legacy e2 studio Projects...". If this menu item is not displayed, go to step 9.

📴 workspace - e ² stud	4	▲	
<u>F</u> ile <u>E</u> dit <u>S</u> ource Ref		New	> ;
🐔 🔅 🔳 🎋 Deb		Go Into	
		Open in New Window	
ବ Project Explorer 🛛		Show In	Alt+Shift+W >
👻 😂 Tutorial [Releas	ľ	Сору	Ctrl+C
> 🔊 Includes	Ē	Paste	Ctrl+V
> 🐸 src	×	Delete	Delete
🗎 custom.bat		Source	>
Description.tx		Move	
🗎 Tutorial Hardv		Rename	F2
🖹 Tutorial Releas	2	Import	
	4	Export	
	Û	Upgrade Legacy e2 studio Projects	
		Build Project	
		Clean Project	

Figure 3-22 Upgrade the Imported Project

8. Select the "Tutorial" project and click [Finish].

0			\times	
Upgrade Legacy e2 studio Projects				
Select projects to upgrade				
✓ [™] Tutorial [Release]				
?	<u>F</u> inish	Cancel		

Figure 3-23 Finish Upgrading

 Open the project properties, select [C/C++ Build] → [Settings] in the left pane. Select tab [Toolchain] and select the latest toolchain for the project. Click [Apply and Close].

Properties for Tuto	prial — 🗌	×
type filter text	Settings 🗢 🔻 🔿	•
 Resource Builders C/C++ Build Build Variables Environment 	Configuration: HardwareDebug [Active]	
Logging Settings Stack Analysis	 Tool Settings Toolchain Device Pauld Steps Pauld Artifact Binary Parsers Enable toolchain integration Current Toolchain 	ļ
Tool Chain Edi C/C++ General MCU Project Natures	Toolchain: [®] Renesas CCRX Version: v2.01.00 Change Toolchain (click Apply before switching tabs)	
Project Natures Project Reference: Renesas QE Run/Debug Settir Task Tags	Toolchain: Renesas CCRX Version: v3.03.00	
Validation		
?	Apply and Close Cancel	

Figure 3-24 Update Project Toolchain

10. Build the project and make sure that it is successful.

3.4.2 Download and Import Sample Projects in the Smart Browser View

You can also download sample projects from the Renesas website through the Smart Browser view. Open the "Renesas Views" -> "Solution Toolkit" -> "Smart Browser" menu (or via "Window" -> "Show View") to open the view. Right-click on an item listed in the [Application Notes] tab and select "Sample Code (import projects)" to import a sample project into the current workspace. The Application Notes marked as "available" in the "Sample Code" column are provided with sample projects.

left Smart Browser X			e e	務 作 % 🎗		✓ 00 ⁶	
Device: R5F566TF(RX66T)	Last upd	lated: 2023/06/29 at 1	7:00:48 JST				
Context Help User's Manual Technical Update Application Notes Too	ol News	Notifications					
223 matches							
Title		Document No.	Rev.	Issue Date	Sample Code	Remarks	^
NEI RX Family Specification Differences Between the RSPI and SCI (Simp	ole S	R01AN2084EJ0101	Rev.1.01	2023/05/30	-		
Servo control sample program RX Family Application Note		R01AN6911EJ0100	Rev.1.00	2023/05/29	available		
RX Family RX Driver Package Ver.1.39		Open			available		
RX Family List of Firmware Integration Technology modules include	ed wi	Sample Code	(download)				
RX family TSIP (Trusted Secure IP) Module Firmware Integration Tech	hnol	Sample Code	(import proi	ects)	available		
RX Family HS300X Sensor Control Module Firmware Integration Tech	hnol		·····baba).	,	available		
OB1203 Sample application - Sample Code		Property			available		\mathbf{v}

Figure 3-25 Application Notes in the Smart Browser View



3.5 Importing SDK Projects for DA Devices

For details on importing SDK projects or the Web site for downloading toolchains, refer to the following FAQ.

FAQ 3000751 Importing DA SDK project into e² studio

The downloaded SDK can be imported into the current workspace.

The following example describes the methods for importing the software development kit (SDK) that has been downloaded from the product page for the DA14531 or DA14535 device.

1. Download the SDK package from the product page for the DA14531 or DA14535 device. Product page for the DA14535: <u>https://www.renesas.com/en/products/wireless-connectivity/bluetooth-low-energy/da14535-smartbond-tiny-da14535-bluetooth-low-energy-53-soc</u>

RENESAS	Products	Applications	Design Resources	Support	Sample & Buy	About	¢	Ä	٢	Q	•
Products / Wireless Connectivity	/ / Bluetooth Low En	ergy / DA14535									
DA14535	Active										
SmartBond TI	NY DA14	535 Blueto	both Low Ene	ergy 5.3	SoC					50	
Order Now	DA14535 Datas SDK6.0.22.1401	heet 🛃 DA14 for DA1453x, DA14	535 Getting Started w	th the Pro-De	velopment Kits					Q 74-FJ(WD	
Overview Documer Orerview Tree	ntation De	sign & Developme	ent Product Optio	ns Supp	ort Videos & T	raining					
* Overview			26 Downloadir								

Figure 3-26 Downloading the SDK Package

2. The following shows an example of a downloaded compressed file. Unzip the downloaded SDK package.

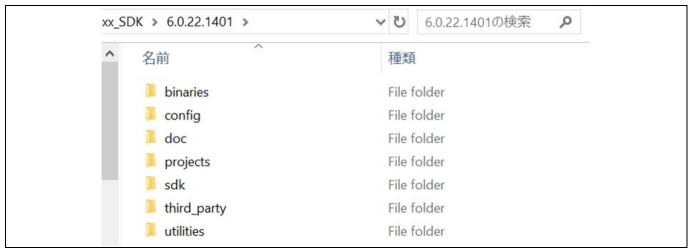


Figure 3-27 Items in the Downloaded SDK Package



3. Start e² studio and open an existing workspace.

🗐 e² studio Launcher	_		\times	
Select a directory as workspace				
e ² studio uses the workspace directory to store its preferences and development artifacts.				
♥ C:\Workspaces\Demos		→ Br	owse	
Use this as the default and do not ask again				
<u>R</u> ecent Workspaces				
Launch		Cance	I	

Figure 3-28 [e² studio Launcher] Dialog Box

4. Click on [Import] in the [File] menu.

C	Demos - e ² stu	dio				
<u>F</u> ile	<u>E</u> dit <u>S</u> ource	Refactor	<u>N</u> avigate	Se <u>a</u> rch	<u>P</u> roject	R€
	<u>N</u> ew			Alt	Shift+N	>
	Open File <u>.</u>					
	Open Projects	from File	System			
	Recent <u>F</u> iles					>
	<u>C</u> lose Editor				Ctrl+W	
	C <u>l</u> ose All Edito	ors		Ctrl+	Shift+W	
	<u>S</u> ave				Ctrl+S	
	Save <u>A</u> s					
Ē	Sav <u>e</u> All			Ctrl	+Shift+S	
	Rever <u>t</u>					
	Mo <u>v</u> e					
2	Rena <u>m</u> e				F2	
\$	Re <u>f</u> resh				F5	
	Con <u>v</u> ert Line [Delimiters	То			>
Ð	<u>P</u> rint				Ctrl+P	
	Import		Import			
4	Exp <u>o</u> rt					
	P <u>r</u> operties			A	Alt+Enter	
	Switch <u>W</u> orks	pace				>
	<u>R</u> estart					
	E <u>x</u> it					

Figure 3-29 Drop-down Menu under [File]

Note: Before importing an SDK project, the relevant toolchain must already have been installed and registered. If you do not know which toolchain the project requires, proceed with the subsequent steps up to Figure 3-35, Specifying the Toolchain, Its Version, and the Target Device, and check the required toolchain and version. For details on installing the toolchain, refer to section 2.4, Installation of Compiler Packages.



5. Select [General] -> [Dialog SDK Project] in the [Import] dialog box and click on [Next].

			1 ×
Select			
Import Dialog SDK project.			
<u>S</u> elect an import wizard:			
type filter text			
▼ 🗁 General			^
🚇 Archive File			
🚔 DA CMake SDK Project (experimenta	al)		
😂 Dialog SDK Project			
😂 Existing Projects into Workspace			
🛱 File System			
Preferences			
Projects from Folder or Archive			
😂 Rename & Import Existing C/C++ Pr	oject into Workspace		
🞏 Renesas CC-RX project conversion to	o Renesas GCC RX		
🞏 Renesas CS+ Project for CA78K0R/C			
Renesas CS+ Project for CC-RX, CC-			
Renesas GitHub FreeRTOS (with IoT Sample Projects on Renesas Website	-		
	9		\sim

Figure 3-30 Importing [Dialog SDK Project]

Note: When an SDK project is to be installed, do not select [Existing Projects into Workspace]. Instead, use the import options of [Dialog SDK Project] as the [Dialog SDK Project] option has been selected in the [Import] dialog box. In response to doing so, the scripts and other settings required for debugging will be properly configured; e.g. the launcher for configuring debugging will correctly be set.



 Select the folder where the SDK was unzipped as [Select SDK root directory:]. Use [Browse] to select the SDK root folder.

8				\times
Import Projects				
Select directory to search for existing pro	ojects			
Select SDK root directory:			~ Bro	owse
Projects:				
			Sele	ct All
			Desel	ect All
			Ref	resh
Options				
 ✓ Search for nested projects ☐ Hide projects that already exist in the 	e workspace			
(?)	Nexts	Einich	Cancol	
A sector of the sector	<u>N</u> ext >	<u>F</u> inish	Cancel	

Figure 3-31 Selecting the SDK Root Folder

7. Select the SDK root folder so that the [config] and [projects] subfolders are included.

							\times
DA1	45xx_SDK > 6.0.22.1401	5 ~	J	6.0.22.1401	の検索		P
ダー						•	?
^	名前				種類		
ſ	📜 binaries				File fol	der	
	📕 config				File fol	der	
	📕 doc				File fol	der	
	projects				File fol	der	
	📜 sdk				File fol	der	
	third_party				File fol	der	
	📜 utilities				File fol	der	
~	<						>
der:	6.0.22.1401						
				Select Folde	r	Cancel	

Figure 3-32 Selecting an SDK Root Folder Including the Required Subfolders

A list of sample projects is shown in the [Project:] panel.
 Select the project to be imported. Here, select the [prox_reporter] project for [e2 studio].
 Click on [Next] to go to the next screen.

		×
Import Projects		
Select directory to search for existing projects		
Select SDK root directory: C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401	× Bro	wse
Projects:		
 host_suotai (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\suota\initiator) mkimage (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\mkimage\gcc) monitor (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\not_apps\windows\proximity\monitor) prodtest (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\prod_test_prod_test_cmds\prodtest) programmer (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\flash_programmer) prox_reporter (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\target_apps\ble_examples\prox_reporter\ccl prox_reporter (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\proximity\reporter\ccl prox_reporter (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\proximity\reporter\ccl geondary_bootloader (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\proximity\reporter) 	Selec Desele Refr	
Options ✓ Search for nested projects ☐ Hide projects that already exist in the workspace		
< Back Next > Einish	Cancel	

Figure 3-33 Selecting the SDK Project

Note: If the selected SDK root folder is incorrect, a warning message will appear. Re-select the SDK root folder that includes the required setting files and subfolders for the project from [Browse].

		\times
Import Projects		
SDK root directory not detected. For correct import from some SDKs, the chosen directory must be the SDK root, which contains config and project subdirectories.		
Select SDK root directory: C:\workspace\SDK_6.0.22.1401\DA145xx_SDK	× Brc	owse
Projects:		
host_suotai (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\suota\initiator)	Selec	ct All
mkimage (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\mkimage\gcc)	Desele	oct Al
\Box monitor (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\host_apps\windows\proximity\monitor)	Deseit	
prodtest (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\prod_test\prod_test_cmds\prodtest)	Refr	resh
programmer (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\flash_programmer)	-	
prox_reporter (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\target_apps\ble_examples\prox_reporter\e2studic)	
prox_reporter (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\projects\target_apps\ble_examples\prox_reporter\Eclipse)		
$\label{eq:linear_reporter} $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$$		
secondary_bootloader (C:\workspace\SDK_6.0.22.1401\DA145xx_SDK\6.0.22.1401\utilities\secondary_bootloader)		
Options	_	
Search for nested projects		
Hide projects that already exist in the workspace		
Figure 3-34 Example of Selection of an Incorrect SDK Root Folder		

RENESAS

 Specify the toolchain, its version, and the target device. The target device can be selected by clicking on [...].

Application Toolchain Setting	IS			
Toolchain:	LLVM Embedded Toolchain for Arm			\vee
Toolchain versio	n: 17.0.1			\vee
Device Settings				
Target device:			- T	
larget device.				
lanage Toolchains				

Figure 3-35 Selecting the Toolchain, Its Version, and the Target Device

10. Select the target device.

8		\times
Device Selection		
You can filter devices by regular expression		
Search Device		
Device		
✓ Dialog		
✓ Dialog/DA1453x		
DA14531		
DA14531_01		
DA14533		
DA14535		
> Dialog/DA1458x		
Dialog/DA1459x		
Dialog/DA1469x		
> Dialog/DA1470x		
Dialog/DA1485x		
> Dialog/DA1487x		
> Dialog/DA16200		
> Dialog/DA16600		

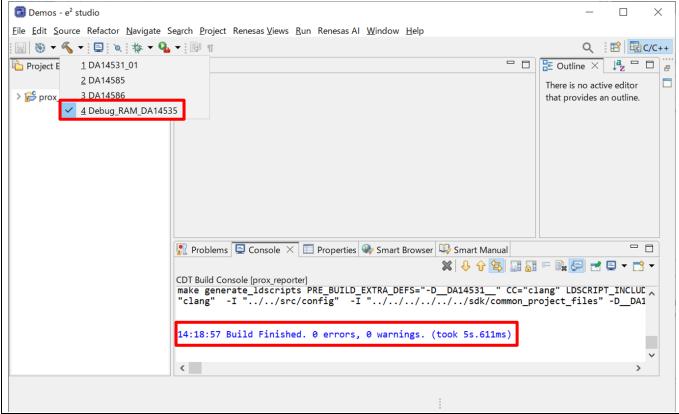
Figure 3-36 Selecting the Device

11. After you have selected the target device, click on [Finish] to import a project.

0					\times
Dialog SDK Projec	t				
Select toolchain and	target device				
Application					
Toolchain Settings					
Toolchain:	LLVM Embedded	Toolchain for Arm			\checkmark
Toolchain version:	17.0.1				\checkmark
Device Settings					
Target device: DA	14535				•••
Manage Toolchains					
?	< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish	Cancel	

Figure 3-37 Completion of Importing the SDK Project

12. Check that building a project is successful.
 Run building by clicking on the icon (downward arrow) -> [Debug_RAM_DA14535].
 On completion of building, the message shown below appears.







4. Build

This chapter describes the build configurations and key build features for the e² studio IDE.

4.1 Build Option Settings

A new project built with the default option can work properly. However, if users would like to change build options (e.g. toolchain version, optimization options, etc.), please follow the following steps before building the project.

1. Right-click on project "Tutorial" and select [Properties] to open the Properties window.

Properties window is supported at the workspace, project and source levels. Properties window for a project supports more configurations which apply across all the files within the same project workspace.

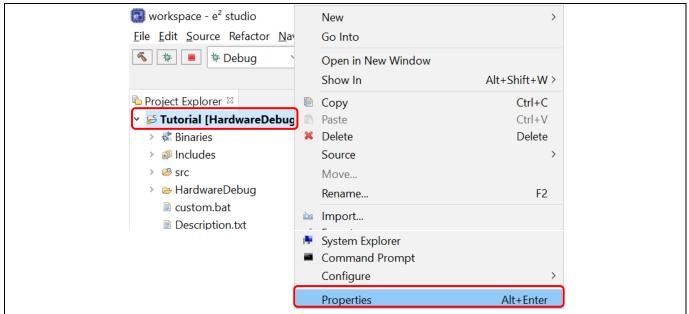


Figure 4-1 Open the Properties Window



2. Click $[C/C++ Build] \rightarrow [Settings] \rightarrow [Toolchain]$ to view or change toolchain version.

Click the "Versions" option to change the toolchain version (if an additional toolchain is installed).

type filter text Settings > Resource Builders Configuration: HardwareDebug [Active] • C/C++ Build Build Variables Environment Settings Tool Settings Toolchain Device > Build Steps > Build Artifact > Binary Parsers > Error Parsers • Tool Settings Stack Analysis Tool Chain Edi Current Toolchain Toolchain: Renesas CCRX
 C/C++ General MCU Project Natures Project Reference: Renesas QE Run/Debug Settir Task Tags Version:

Figure 4-2 Change Toolchain Version

3. Click [C/C++ Build] \rightarrow [Environment] to set build option and add or edit the environment variables.

Properties for Tuto	orial				
type filter text	Environment				← ▼ ⇔ ▼ 8
> Resource					
Builders	Configuration: Ha	advana Dalavar, I.A.a	thur 1	× Manage	C C
✓ C/C++ Build	Configuration: Ha	rdwareDebug [Ac	uvej	* Manage	Configurations
Build Variables					
Environment	Environment variat	ales to set			Add
Logging	Variable	Value	Orinin		Add
Settings			Origin		Select
Stack Analysis	AMS_KEEP_FILE	\${synergyKeep			Edit
Tool Chain Edi		\${synergyLicens			
> C/C++ General	ArtifactName	Tutorial	BUILD SY		Delete
> MCU	CWD	C:\Users\Renes			Undefine
Project Natures	PATH	C:\Program File			
Project Reference:	PWD	C:\Users\Renes			
Renesas QE	TCINSTALL	C:\Program File			
Run/Debug Settir	TC_VERSION	v3.03.00	BUILD SY		
Task Tags > Validation	Append variable	as to pativo opviror	amont		
Validation	Replace native e				
		environment with s	pecified one		
< >				Restore <u>D</u> efaults	Apply
?				Apply and Close	Cancel

Figure 4-3 Build Environment Settings



4. Setting Build Options

e² studio

Right-click on a project in the Project Explorer and select [Properties] to open the Properties window.

Build options for the compiler and linker, etc. can be set on "C/C ++ Build" \rightarrow "Settings" \rightarrow "Tool Setting" tab.

Users could set all build settings under the 'Tool Settings' tab.

The "Build configuration" can be switched via the "Configuration:" dropdown list at the top of the window. Each build configuration manages a set of build options.

Click [Apply and Close] to save the build setting changes.

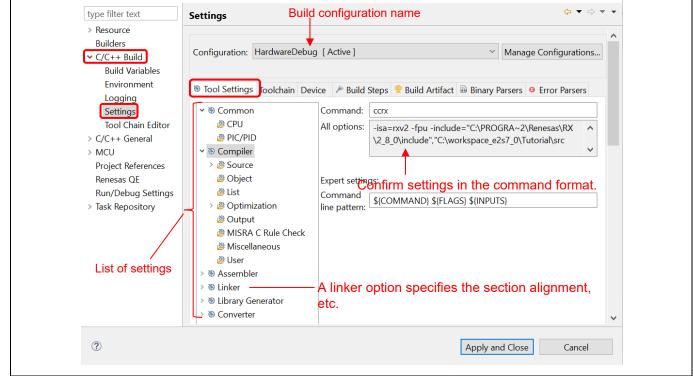


Figure 4-4 Build Option Settings

Details of build options are described in the compiler user's manual which is stored at "{Compiler installation directory}\doc". For example, it can be found in "C:\Program Files (x86)\Renesas\RX\3_2_0\doc\".

Note: There is "*Toolchain Editor*" under "C/C++ Build", **please do not change the configuration**. The Toolchain editor is used for toolchains which are NOT supported by Renesas build support plugins.



4.2 Build a Sample Project

A project can be built by the steps below:

1. Right-click on the project and select [Build Project].

Project Explorer 💥	4	Export	
v 👺 Tutorial [HardwareDebug]	C	Build Project	
✓ M Includes		Clean Project	
🕟 📴 C:/Program Files (x8 🖇	2	Refresh F5	
🕒 Tutorial/generate		Close Project	
✓ 2 generate		Close Unrelated Projects	
> c dbsct.c			

Figure 4-5 Build a Sample "Tutorial" Project

2. Check that the [Console] pane shows the 'Build complete.' message to indicate a successful build.

At the end of this build, files output to the \${CONFIGDIR} directory consists of "makefile", "Tutorial.abs", "Tutorial.map", "Tutorial.mot", "Tutorial.x", etc.

"Tutorial.abs" is a Renesas standard load module in the ELF/DWARF format (*.abs) used for debugging. Because GDB supports a load module format with the different ELF/DWARF specification (*.x or *.elf), hence "Tutorial.abs" has to be converted to "Tutorial.x" for debugging in the e² studio IDE.

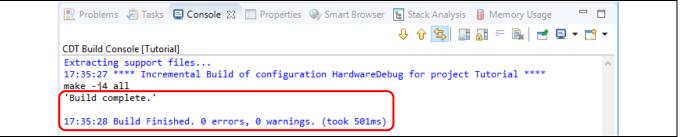


Figure 4-6 Project is Built Successfully.

3. In some cases, the build can be unsuccessful. The console window will show error messages, please check it and revise the source code or configuration and rebuild the project.

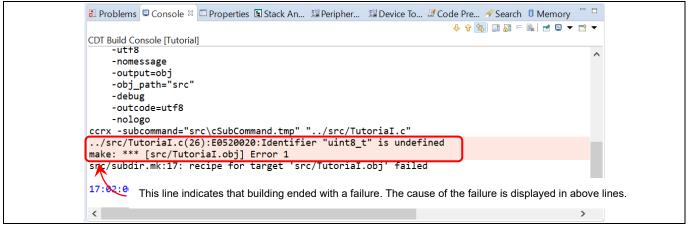


Figure 4-7 Unsuccessful Build Shows Error Messages



4.3 Export Build Configuration Settings

The Project Reporter feature can export project and build configuration settings from the e² studio IDE to a file for easy checking and comparison of project/build environment settings.

- 1. Right-click at [Project Explorer] to pop up the context menu.
- 2. Select [Renesas C/C++ Project Settings] -> [Save build settings report] to save the build settings report.

\$	C/C++ Project Settings	Ctrl+Alt+P		
	Renesas C/C++ Project Settings	>		Change Device
*	Run C/C++ Code Analysis			Change Toolchain Version
1	System Explorer			Save build settings report
(ES.,	Command Prompt		Г	

Figure 4-8 Project Reporter



5. Debug

This chapter describes the usage of debug configuration and key debugging features for e² studio. The following illustration refers to "Tutorial" project built (in Chapter 4.2) and based on the hardware configurations of the E2 emulator Lite and RSK RX64M board.

Firstly, open the "Tutorial" project workspace in the e² studio IDE and click the [Debug] perspective.

	* Debug Smart Configurator # FSP Configuration						
Figure 5-1 Switch To [Debug] Perspective							

Perspective defines the layout views (related to development tools) in the Workbench window. Each perspective consists of a combination of views, menus and toolbars that enable users to perform the specific task.

For instance, the [C/C++] perspective has views that help users to develop C/C++ programs and the [Debug] perspective has views that enable users to debug the program. If users attempt to connect the debugger in the [C/C++] perspective, the IDE will prompt users to switch to the [Debug] perspective.

One or more perspectives can exist in a single Workbench window. Users can customize them or add new perspective.

Note: For more information on debug, please refer to "e2 studio User Guide" as described in chapter 6.

5.1 Change Existing Debug Configurations

The debug configuration has to be configured when debugging for the first time and it just needs to be done once. An existing debug configuration can be changed as follows.

1. Click the "Tutorial" project in the [Project Explorer] pane to set focus.

Click [Run] \rightarrow [Debug Configurations...] or icon (downward arrow) \rightarrow [Debug Configurations...] to open the "Debug Configurations" window.

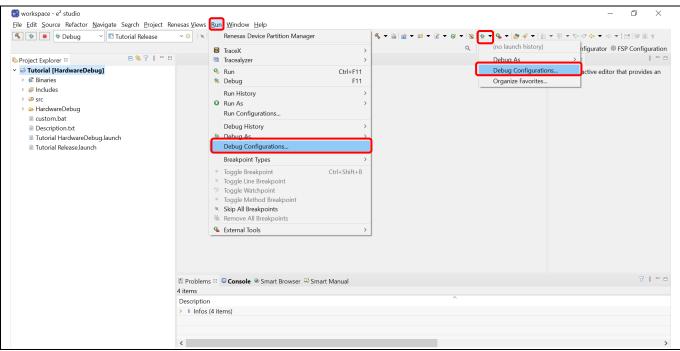


Figure 5-2 Open the Debug Configurations Window



2. In the "Debug Configurations" window, go to [Renesas GDB Hardware Debugging] → [Tutorial HardwareDebug]. Click on the [Main] tab to ensure the load module is "Tutorial.x".

Debug Configurations				
reate, manage, and run configurations				Ś
Image: Second Structure Image: Second Structure Image: Second Structure Image: Second Structure <th>Name: Tutorial HardwareDebug Main Debugger Startup Project: Tutorial C/C++ Application: HardwareDebug\Tutorial.x Build (if required) before launching Build Configuration: Build Configuration: Use Active ○ Enable auto build</th> <th>Variables</th> <th>ace Settings</th> <th>Browse</th>	Name: Tutorial HardwareDebug Main Debugger Startup Project: Tutorial C/C++ Application: HardwareDebug\Tutorial.x Build (if required) before launching Build Configuration: Build Configuration: Use Active ○ Enable auto build	Variables	ace Settings	Browse
ilter matched 14 of 17 items			Re <u>v</u> ert	Apply
(?)			<u>D</u> ebug	Close

Figure 5-3 Select the Load Module

3. Switch to the [Debugger] tab, set "E2 Lite (RX)" as the debug hardware and "R5F564ML" as the target device.

<u>N</u> ame:	Tutorial HardwareDebug	
🗎 Mai	n 🏁 Debugger 🕨 Startup 💱 Source 🗉 <u>C</u> ommon	
Debu	ig hardware: E2 Lite (RX) Yarget Device: R5F564ML	

Figure 5-4 Select the Target Device

- 4. Under the [Debugger] tab, go to the [Connection Settings] sub tab which is related to emulator connection. The following example is based on the environment with the E2 emulator Lite and RSK RX64M board:
 - Clock
 - Main Clock Source = "EXTAL"
 - Extal Frequency (MHz) = "24.0000"

Note: Extal frequency is the value printed on the oscillator device on your board.

- Connection with Target Board
 - Connection Type = "JTag"

RENESAS

- JTag Clock Frequency [MHz] = "6.00"
- Hot plug = "No"

The hot plugin feature is only available with the device which has the capability. Please refer to the device hardware manual for "On chip debugger" specifications for the details.

- Power
 - Power Target From The Emulator (MAX 200mA) = "No"

Choose "Yes" if you would like to supply power through an emulator, when external power is unplugged. Choose "No" if external power is plugged.

- Communication Mode
 - Mode = "Debug Mode"

Another communication mode "Write On Chip Flash Memory" is used for flashing codes including an ID code area, although the debugger will be disconnected after flash.

Note: This debug configuration in Figure 5-5 is shown as an example. The wrong settings may cause malfunction or damage to the hardware. So, pay attention to verify the board and emulator settings before connection.

ame: Tutorial HardwareDebug		
🗈 Main 🎋 Debugger 🕨 Startup 💷 <u>C</u> ommon 🦻 Source		
Debug hardware: E2 Lite (RX)	4ML	
GDB Settings Connection Settings Debug Tool Settings		
Main Clock Source	EXTAL	~ ^
Extal Frequency[MHz]	24.0000	
Operating Frequency [MHz]	48	
Permit Clock Source Change On Writing Internal Flash M	emory Yes	~
 Connection with Target Board 		
Emulator	(Auto)	
Connection Type	JTag	~
JTag Clock Frequency[MHz]	6.00	~
Fine Baud Rate[Mbps]	1.50	\sim
Hot Plug	No	~
✓ Power		
Power Target From The Emulator (MAX 200mA)	No	~
Supply Voltage (V)	3.3	\sim
✓ CPU Operating Mode		
Register Setting	Single Chip	~
Mode pin	Single-chip mode	✓
Change startup bank	No	\checkmark
Startup bank	Bank 0	\checkmark
✓ Communication Mode		
Mode	Debua Mode	~ ~

Figure 5-5 Change Connection Setting



5. For details on switching to the [Debug Tool Settings] sub tab which is related to the debugger behavior, please refer to the e² studio Help content at "e² studio User Guide" → "Debugging Projects".

Debug Configurations		_		×
Create, manage, and run configuration	ns		Ŕ	Š
				< .
〕 ₽ 🖗 🗎 🗶 🖻 🍸 👻	Name: Tutorial HardwareDebug			
type filter text	■ Main 参 Debugger ► Startup ♥ Source □ Common			
 C/C++ Application C/C++ Remote Application EASE Script 	Debug hardware: E2 Lite (RX)	L		
© GDB Hardware Debugging	GDB Settings Connection Settings Debug Tool Settings			
GDB OpenOCD Debugging	× 10			^
🖻 GDB Simulator Debugging (RH850)	Use Default IO Filename	Yes	\sim	
🜌 Java Applet	IO Filename	\${support_area_loc}		
🗉 Java Application	✓ General Debug			
🗣 Launch Group	Reset After Reload	Yes	~	
🖳 Remote Java Application	V Memory			
🖌 🖻 Renesas GDB Hardware Debugging	Endian	Little Endian	~	
📧 Tutorial HardwareDebug	Verify On Writing To Memory	No	~	
📧 Tutorial Release	Internal Flash Memory Overwrite	[1158]		
🖻 Renesas Simulator Debugging (RX, RI	External Memory Areas	[0]		
	Work RAM Start Address	0x1000		
	Work RAM Size (Bytes)	0x500		
	✓ System			
	Debug the program re-writing the on-chip PROGRAM ROM	1 No	\sim	
	Debug the program re-writing the on-chip DATA FLASH	No	× .	
	V Start/Stan Eurotian Satting			¥
> ilter matched 14 of 17 items		Re <u>v</u> ert	Apply	
?		Debug	Close	
		Debug	Close	

Figure 5-6 Change Debug Tool Settings

- Memory
 - Endian = "Little Endian"

Endian setting of debugger memory reference. This configuration does not affect the target program behavior.

"Internal Flash Memory Overwrite", "External Memory Areas"

These configuration control to allow/deny flashing blocks upon downloading modules. Uncheck specific memory blocks if you would like to reserve the contents.

6. Click the [Apply] button to confirm and save the settings. Then click [Debug] to connect the debugger and start downloading the load module.



7. For a successful connection, the [Debug] view shows the target debugging information in a tree hierarchy. The program is halt at the entry point "PowerON_Reset() in "resetprg.c".



Figure 5-7 User Target Connection in the [Debug] View



5.2 Create New Debug Configurations

The simplest way to create a new debug configuration is by duplicating an existing one. It can be done by the following steps.

- 1. Repeat step 1 in section 5.1 to open the "Debug Configurations" window.
- Select a debug configuration (e.g. "Tutorial HardwareDebug") and then click the icon (Duplicates the currently selected launch configuration). A new debug launch configuration (e.g. "Tutorial HardwareDebug (1)") is created. Users can rename it to identify the settings by typing in the "Name" textbox then click the [Apply] button.

Debug Configurations		— C) X
Create, manage, and run configurations			Ť.
Image: Second Structure Image: Second Structure	Name: NewDebugConfig Main		ables
0	<u>D</u> ebug	C	lose

Figure 5-8 Duplicate a Selected Debug Launch Configuration

Note: If no debug configurations have been created and duplication is not possible, then right-click the load module (extension *.x or *.elf) in Project Explorer to start the debugger with "Debug As" \rightarrow "Renesas GDB Hardware Debugging" (or "Renesas Simulator Debugging" for the simulator), and then back to the Debug Configurations dialog to make the required settings.

- 3. The debug launch configuration can be configured as described in chapter 5.1. For example, change the Debug Hardware to "E2 Lite (RX)".
- 4. If the launch configuration was added with [local] and * (red star) marker, it is not yet attached to any project. Then please specify the project name in the Common tab.

Name: Tutorial Har	dwareDebug		
🗎 Main 🎋 Debugg	er 🕨 Startup 💱 Source 💷 <u>C</u> ommon		
Save as			
• Shared file:	\Tutorial	<u>B</u> rowse	

Figure 5-9 Attach Launch Configuration to Specific Project



5.3 Launch Bar

This section explains the usage of 'Launch Bar' in the toolbar area of the e² studio main window. This interface is hidden by default in some of e² studio versions.

The interface shown below builds and debugs the selected launch target. (May or may not be the same project as the active project in Project Explorer.)

File Edit Source Refactor Navig	te Search Project Re	enesas Views Run	Window Help
🐔 🔅 🔳 🔅 Debug	🗸 💽 myprj Ha	ardwareDebug	✓ # i %
Buttons to perform build or debug the se	ected launch target	Select the target b	uild/debug

Figure 5-10 Launch Bar Interface

Launch Bar buttons behave as follows:

• K button builds the load module of the selected launch configuration.

Note: There is another build button **S** in the "File" toolbar that builds active build configuration of Project Explorer, while the launch bar does not reflect the active state in Project Explorer.

• 🗼 🔳 buttons are trigger of debugger launch and terminate the selected launch target.

Launch Bar and build button can be shown or hidden through the following dialog.

• Click [Window] menu \rightarrow [Preferences], then click [Run/Debug] \rightarrow [Launching] \rightarrow [Launch Bar].



5.4 Basic Debugging Features

This section explains the typical Debug views supported in the e² studio IDE.

- Standard GDB Debug (supported by Eclipse IDE framework): Breakpoints, Expressions, Registers, Memory, Disassembly and Variables
- Renesas Extension to Standard GDB Debug: Eventpoints, IO Registers and Trace.

The following are some useful buttons that exist in the [Debug] view:

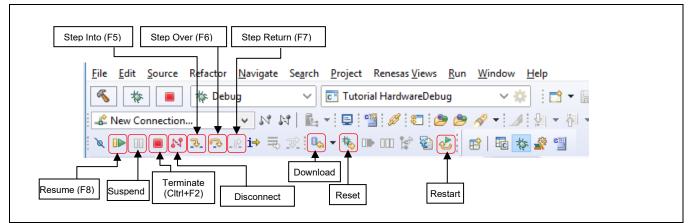


Figure 5-11 Useful Toolbars In Debug Views

The program is run by clicking the IP button or pressing [F8].

The program can be paused by a breakpoint or by clicking the button. When the program is paused, users can perform the following operations:

- The 🔧 button or [F5] can be used for stepping into the next method call at the currently executing line of code.
- The 🐼 button or [F6] can be used for stepping over the next method call (executing but without entering it) at the currently executing line of code.
- The Ib button can be clicked again to resume running.

To stop the debugging process, the 📕 button is clicked to end the selected debug session and/or process or the 🕅 button is clicked to disconnect the debugger from the selected process.

The other operations are as follows:

- The 🕹 button can be clicked to start a new debug session. This is the same operation as clicking on 🍇 and then 🕪.
- The K button can be clicked to reset the program to the entry point at PowerOn Reset.
- The U₅ button is used for re-downloading the binary file to the target system.

Note: To demonstrate the features in the following section, please use the sample code for RX64M from the Renesas website as instructed in section 3.4.1.

5.4.1 Breakpoints View

The Breakpoints view stores the breakpoints that were set on executable lines of a program. If a breakpoint is enabled during debugging, the execution suspends before that line of code is executed. e² studio allows software and hardware breakpoints to be set explicitly in the IDE. Any breakpoints added via double-clicking on the marker bar are by default hardware breakpoints. If the hardware resources are not there then the breakpoint setting will fail. In case of a hardware breakpoint setting failure, an error message will prompt users to switch to a software breakpoint.

To select a default Hardware or Software breakpoint type:

Right-click on the marker bar to pop up the context menu. For a hardware breakpoint, select [Breakpoint Types] → [e² studio Breakpoint]. For a software breakpoint, select [Breakpoint Types] → [C/C++ Breakpoints].

To set a breakpoint:

- 1. Open "r_cg_main.c", double-click on the marker bar located in the left margin of the [C/C++ Editor] pane to set a breakpoint. A dot <a>a (Hardware breakpoint) or <a>(Software breakpoint) is displayed in the marker bar depending on the [Breakpoint Type] selected. [Breakpoint Type] is hardware breakpoint by default.
- 2. Alternatively, right-click at the marker bar to choose [Toggle Hardware Breakpoint] or [Toggle Software Breakpoint] to set a hardware breakpoint 20 or a software breakpoint 20.
- Click [Window] → [Show View] → [Breakpoints] or icon ^{So} (or use shortcut key [ALT] + [Shift] + [Q], [B]) to open the [Breakpoints] view to view the corresponding software breakpoints set. Software breakpoints can be enabled and disabled in the [Breakpoints] view.

To disable breakpoints, users can choose to disable specific breakpoints or to skip all breakpoints:

- To disable a specific breakpoint, right-click on the Software breakpoint or Hardware breakpoint located in the left margin of the [C/C++ Editor] pane and select [Disable Breakpoint], or uncheck the related line in the Breakpoints view. A disabled breakpoint is displayed as a white dot (or or). The breakpoint is restored to enabled by selecting [Enable Breakpoint] from the context menu. Alternatively, double-clicking while pressing the shift key switches between disabling and enabling of the breakpoint.
- 2. To skip all breakpoints, click on the kicon in the Breakpoints view. A blue dot with a backslash will appear in the editor pane as well as in the Breakpoints view.

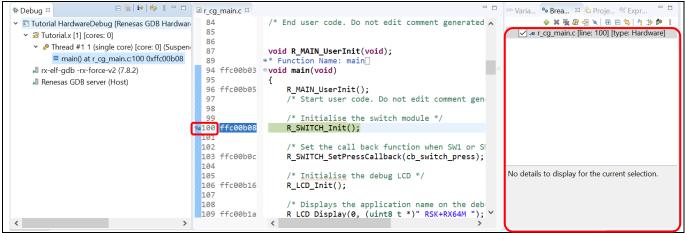


Figure 5-12 [Breakpoints] View



5.4.2 Expressions View

The Expressions view monitors the value of global variable, static variable or local variable during debugging. For all RX debuggers, these variables (including the local variables in scope) can be set for real-time refresh. Values of variables can be registered by names, expressions (e.g. "Aval+Bval*2"), and cases of type casting (e.g. "(struct mystr *)&buf[1]").

Expression	Туре	Value	Address	Name : adc_count	^
R adc_count	uint8_t	0 "\0"	0x485	Details:0 '\0' Default:0 '\0' Decimal:0 Hex:0x0 Binary:0 Octal:0	~
<			2	> <	>
r_cg_resetprg.c	💽 r_cg_main.c 🔅	r_okaya_lcd.c			
67 68 69 71 72 73 73 74 75	/* Prototype de static void loc /* Prototype de static void une /* Variable to	t get_adc (void); eclaration for lcd_displa d_display_adc (const uint eclaration for uart_displ et_display_adc (const uin store the A/D conversion	16_t adc_result); ay_adc */ t8_t adc_count, cons	//	
76 77 78 79	/* Prototype de	<pre>adc_count = 0; eclaration for led_displa d display count (const ui</pre>			

Figure 5-13 [Expressions] View

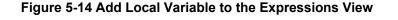
To watch a global variable,

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Expressions] or icon $\frac{6}{10}$ to open the [Expressions] view.
- 2. Drag and drop a global variable over the [Expressions] view. (Alternatively, right-click at the global variable to select the "Add Watch Expression..." menu item to add it to the [Expressions] view).
- 3. In the [Expressions] view, right-click to select the "Real-time Refresh" menu item. This refreshes the expression value in real-time when the program is running. The character "R" indicates that this global variable will be updated in real-time.
- 4. To disable the "Real-time Refresh", simply right-click to select the "Disable Real-time Refresh" menu item.



🏝 📲 🖃 💠 🗶 💥 📑 😁 🏟 🚈 Variables 🔹 Breakpoints 🕮 Registers 😤 Expressions 🛛 🗨 Eventpoints 🗟 Peripherals 🗊 IO Registers Multiple errors reported. Expression Туре Value Address . R adc_count uint8_ 17 '\02 0x485 1) Failed to execute MI command: Error: Multiple errors reported.\ Failed. adc result -data-evaluate-expression & (adc_result) Error message from debugger back end: No symbol "adc_result" in current context. Add new expression 2) Failed to execute MI command: -var-create - * adc_result
Error message from debugger back end: -var-create: unable to create variable object 3) Unable to create variable object Failed to execute MI command: -data-evaluate-expression adc result Error message from debugger back end: No symbol "adc_result" in current context. 5) Failed to execute MI command: -var-create - * adc_result Error message from debugger back end: -var-create: unable to create variable object - 8 ⊡ r_c I r_cg_main.c ⊠ I r_cg_resetprg.c :gc.c 116 * Set up SCI7 receive buffer and callback function */ ^ 117 f1c00b46 R_SCI7_Serial_Receive((uint8_t *)&g_rx_char, 1); 118 119 * Enable SCI7 operations */ 120 ffc00b50 R_SCI7_Start(); 121 while (1U) 123 124 uint16_t adc_result; 125 Wait for user requested A/D conversion flag to be set (SW1 or SW2) */ 126 127 ffc00bf5 if (TRUE == g_adc_trigger) 128 { 129 Call the function to perform an A/D conversion */ adc_result = get_adc(); 130 ffc00b57 131 132 /* Displav the result on the LCD */ <

Local variables can be added in the same way. However, the watch is not available when the program is running out of the scope of the variable.



For a variable of which address is uniquely determined (static variable), the value can be referenced by explicitly specifying the scope even when the variable is executing outside the scope.

For example, if you want to refer to the "myval" variable in the scope of the function myfunc(), you can create it in the Expressions view in the format "myfunc::myval" (with two colons between them).



5.4.3 Registers View

The Registers view lists the information about the general registers of the target device. Changed values are highlighted when the program stops.

1010 0	·		🖾 🐗 🕞 📑 🛃 🍫 🍸 🖻	Π
iiii R	egisters 🛛			
Na	me	Value	Description	
4	# General Registers		General Purpose and FPU Register Group	
	1999 rO	0x1518		_
	1888 r1	0x0		=
	1999 r2	0x0		
	888 r3	0x0		
	1000 r4	0x10		
	888 r5	0x80		
	888 r6	0x100b		
	3889 r7	0x1010		
	888 r8	0x0		
	888 r9	0x0		
	!!!! r10	0v0		Ψ.
•		1	4	
Nam	ne : r0 Hex:0x1518 Decimal:5400 Octal:012430 Binary:1010100 Float:7.567011 Default:5400			*

Figure 5-15 [Registers] View

To view the general register "r0",

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Registers] or icon ¹⁰⁰/₁₀₀ to open the [Registers] view.
- 2. Click "r0" to view the values in different radix format.

Values that have been changed are highlighted (e.g. in yellow) in the [Registers] view when the program stops.



5.4.4 Memory View

The Memory view allows users to view and edit the memory presented in "memory monitors". Each monitor represents a section of memory specified by its location called "base address". The memory data in each memory monitor can be presented in different "memory renderings", which are the predefined data formats (e.g. Hex integer, signed integer, unsigned integer, ASCII, image etc.).

To view a variable (e.g. "adc_count") in the Memory view,

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Memory] or icon [1] to open the [Memory] view.
- 2. Click the icon 📌 to open the [Monitor Memory] dialog box. Enter the address of the variable "&adc_count".

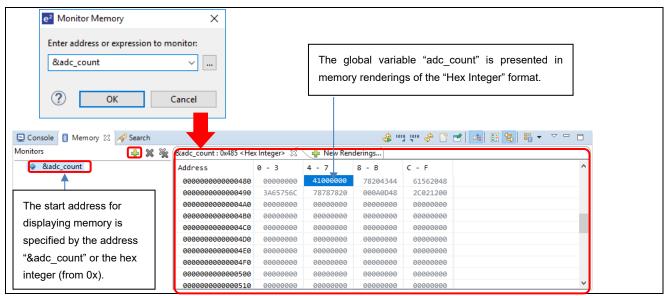


Figure 5-16 [Memory] View (1/2)



 To add new renderings format (e.g. Raw Hex) for the variable "adc_count", click the tab to select "Raw Hex" to add the rendering.

This creates a new tab named "&adc_count < Raw Hex>" next to the tab "&adc_count<Hex Integer>".

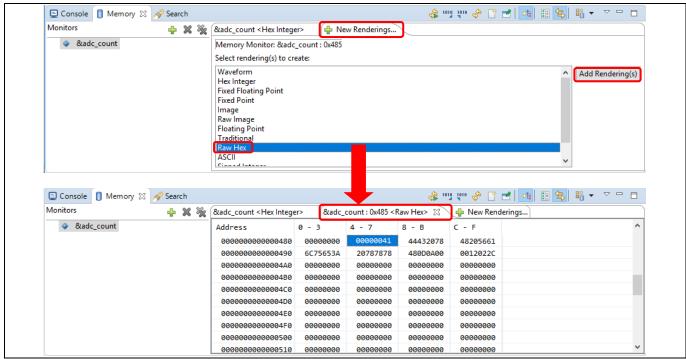


Figure 5-17 [Memory] View (2/2)



5.4.5 Disassembly View

The Disassembly view shows the loaded program as assembler instructions mixed with the source code for comparison. The current executing line is highlighted by an arrow marker in the view. In the [Disassembly] view, users can set breakpoints at the assembler instruction, enable or disable these breakpoints, step through the disassembly instructions and even jump to a specific instruction in the program.

r_cg_resetprg.c	🖻 r_cg_main.c 🛛			
98				^
99	/* Initialise t	the switch module */		
100 ffc00b08	R SWITCH Init()			
101		,		
102	/* Set the call	back function when SW1	or SW2 is pressed */	
103 ffc00b0c		ssCallback(cb switch pr		
104		(= =		
105	<pre>/* Initialise 1</pre>	the debug LCD */		
106 ffc00b16	R LCD Init();	U U		
107				
108	/* Displays the	application name on the	e debug LCD */	
109 ffc00b1a	R_LCD_Display(@), (uint8_t *)" RSK+RX64	M ");	
110 ffc00b26		l, (uint8_t *)" Tutorial		
111 ffc00b32	R_LCD_Display(2	2, (uint8_t *)" Press An	y Switch ");	
112				_
113	/* Start the A/	D converter */	his allows the assembly source to be	
	<	lir	nked with the C source (active debug	
-			· · · ·	
📑 Outline 🔛 Dis	assembly 🔀 🚹 Project Exp	olorer	ontext).	
	Opcodes Functi	on Offsets nter location here	· 🗸 🚯 🕞 👔 🗸	₫ ▽
ffc00b05: 0	x00000039fd00 main+2	bsr.w 0xffc00c02 <r< td=""><td>MAIN_UserInit></td><td>~</td></r<>	MAIN_UserInit>	~
100		<pre>R_SWITCH_Init();</pre>		
ffc00b08: 0	x000005651000 main+5	bsr.a 0xffc01b6d <r< td=""><td></td><td></td></r<>		
103			llback(cb_switch_press);	
	xfb12030cc0ff main+9	mov.l #0xffc00c03,		
	x000005611000 main+15		_SWITCH_SetPressCallback>	
106		<pre>R_LCD_Init();</pre>		
	x0000053b0b00 main+19	bsr.a 0xffc01651 <r< td=""><td></td><td></td></r<>		
109			int8_t *)" RSK+RX64M ");	
	xfb22e006c0ff main+23		r2	
	x000000006601 main+29	mov.l #0, r1		
ttc00b22: 0	x000005420b00 main+31	bsr.a 0xffc01664 <r< td=""><td></td><td></td></r<>		
		P ICD Dicplay(1 (m	<pre>int8 t *)" Tutorial ");</pre>	
110	Shaar and a 22 and a 1 start			
	xfb22ec06c0ff main+35	mov.l #0xffc006ec,		~

Figure 5-18 [Disassembly] View



To view both C and assembly codes in a mixed mode,

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Disassembly] or icon $\stackrel{\text{IIII}}{=}$ to open the [Disassembly] view.
- 2. Click icon ⁵ to enable the synchronization between assembly source and the C source (active debug context).
- 3. In the [Disassembly] view, right-click at the address column to select "Show Opcodes" and "Show Function Offsets".
- 4. You can enable source addresses within the editor using the context menu.

 Toggle Monitor Point Enable/Disable Monitor Point Add Bookmark Add Task Show Source Addresses Show Eventpoints Show Quick Diff Ctrl+Shift+Q Show Line Numbers Folding 		OU LO ANNOLALION	Cuiti
Add Bookmark Add Task Show Source Addresses Show Eventpoints Show Quick Diff Ctrl+ Shift+Q Show Line Numbers	0	Toggle Monitor Point	
Add Task Show Source Addresses Show Eventpoints Show Quick Diff Ctrl+ Shift+Q Show Line Numbers		Enable/Disable Monitor Point	
Show Source Addresses Show Eventpoints Show Quick Diff Show Line Numbers		Add Bookmark	
 Show Eventpoints Show Quick Diff Ctrl+Shift+Q Show Line Numbers 		Add Task	
Show Quick Diff Ctrl+Shift+Q Show Line Numbers Ctrl+Shift+Q	~	Show Source Addresses	
Show Line Numbers	~	Show Eventpoints	
	~	Show Quick Diff	Ctrl+Shift+Q
Folding >	~	Show Line Numbers	
		Folding	>
Preferences		Preferences	

Figure 5-19 Source Addresses Menu

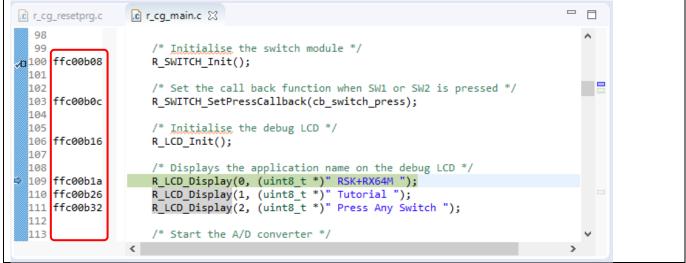


Figure 5-20 Source Addresses Displayed in the Editor



5.4.6 Variables View

The Variables view displays all the valid local variables in the current program scope.

Please refer to 'Expressions' view (refer to section 5.4.2) to watch global variables or external variables out of current program scope.

Name	Туре	Value	Name : position Details:0 '\0'	^
(×)= position	const uint8_t	0 '\0'	Default:0 \0	
> ➡ string	uint8_t * const	0xffc006e0 " RSK+ RX64M "	Decimal:0 Hex:0x0 Binary:0 Octal:0	v
			<	>
c r_cg_resetprg.c	🖸 r_cg_main.c 🚺 r_okaya	a lcd.c 🔀		
98 100 103 112 ffc01664	<pre> * End of function R_LCD_ * Function Name : R_LCD_I ovid R_LCD Display (uint) </pre>			^

Figure 5-21 [Variables] View

To observe a local variable (e.g. "position" for function "R_LCD_Display()"),

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Variables] or icon \bowtie to open the [Variables] view.
- 2. Step into the function "R_LCD_Display()" to view the value of local variable "position".

Note:

The variables which optimized out or temporarily allocated to accumulator registers may not appear in this view. Please refer to the Disassembly view if necessary to confirm which registers (also refer to the Registers view) or memory are used as the variable.

By disabling optimization, variables would become visible in most of the cases. However, it means to give up all benefits of optimization such as memory efficiency, code size reduction and performance improvement.



5.4.7 Eventpoints View

An event refers to a combination of conditions set for executing break or trace features during program execution. The [Eventpoints] view enables users to set up or view defined events of different category; e.g. trace start, trace stop, trace record, event break, before PC break, performance (timer) start and performance (timer) stop.

The number of events that can be set and the setting conditions differ with each MCU. These are two (2) types of events:

- Execution address: The emulator detects execution of the instruction at the specified address by the CPU. It can be a "before PC" break (e.g. with events, a condition is satisfied immediately **before** execution of the instruction at the specified address) or other events (e.g. with events, a condition is satisfied immediately **after** execution of the instruction at the specified address).
- Data access: The emulator detects access under a specified condition to specified address or specified address range. This allows users to set up complex address and data matching criteria.

The combination of events (e.g. OR, AND (cumulative) and Sequential) can be applied to two (2) or more events.

🗣 Eventpoints 🛛 💁 Breakpoints 🔤 Registers 🛋 Modules 🕰 Expressions 🔲 IO Registers 🌾 Variables								
			🔌 🗶 🎉	6 Q	🍆 PC:	0/2 OA: 0/2	8 🖻	
Туре	Address	Data	Count	Timer	Channel	Comment		
🗌 🎁 Trace Start								
Trace Stop								
C: Event Break								
□ 💽 · Timer Start								
🗌 🕐 Timer Stop								
	Cg Edi	t Event Break						X
						Trigger:	OR	- 4 f
	Туре	Address	Data	Count	Timer (Channel Comme	ent	
	Ad	d Edit Delete	PC: 0/8 OA: 0/4 AI	I: 0				
						ОК		Cancel

Figure 5-22 [Eventpoints] View (1/2)

To set an event break for a global variable when address/data is matched (e.g. when adc_count = "0x6"),

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Eventpoints] or icon \bigcirc to open the [Eventpoints] view.
- 2. Double-click at the "Event Break" option to open the [Edit Event Break] dialog box.
- 3. Click the [Add...] button to continue.



		Add Eventpoint				×
	c	Eventpoint Type: Data	Access		\sim	
		Address Settings Dat	a Acces	s Setti	ngs	
		Address:		adc_co		
	I					
	1	Add Eventpoint				×
		Eventpoint Type: Data	Access	5		
		Address Settings Dat	a Acces	ss Sett	ings	
		Data Settings:				
		Read/Write:	F	Read/V	Vrite	~
		Size:	١	Not Sp	ecified	~
		Bus Master:		CPU		~
		Compare Settings:		0.6		
		Compare:		0x6		
		Mask Value:		0		
		Comparison:	t	Equals		×
		Trigger Count:		Time	r:	\sim
Contraction of the						
Colline Edit Event Br	еак					Trigger: OR 🗸 🕂 🕆
Туре	Address	Data	Count	Timer	Channel	Comment
🗹 💧 OR	&_\$adc_count	Read/Write All Compare (0x6)				
Add	Edit Dele	te PC: 0/8 OA: 1/4 All: 1				
						OK Cancel
						Concer

Figure 5-23 [Eventpoints] View (2/2)

- 4. Select "Data Access" as the eventpoint type.
- 5. Go to the [Address Settings] tab, click the icon 🛄 to browse for the symbol "_\$adc_count". (The address of this global variable is "&_\$adc_count".)

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- 6. Next, switch to the [Data Access Settings] tab, enable the [Compare Settings] checkbox and set the compare value equal to "0x6". Click [OK] to proceed.
- 7. Ensure that the event break for "adc_count = 0x6" is set and enabled in the [Eventpoints] view. Reset to execute the program from the start. Press SW1 six times.

(x)= Variables	nts 🚻 Registers 🙀	'Expressions 🙁 🧧 Eventpo	pints	
			🆾 🍕 🕞 🕂 🗙 🔌 📑 🗈	1 🔯 🗸
Expression	Туре	Value	Name : adc_count Details:6 '\006'	A
R adc_count	uint8_t	0хб (Нех)	Default:6 '\006'	
🐈 Add new expression			Decimal:6 Hex:0x6	
			Binary:110	
			Octal:06	
<			> <	>
c r_cg_resetprg.c	r_cg_main.c 🛛 🔓	r_okaya_lcd.c		
134				^
135 136 ffc00b5f ⊖		ement the adc_count an == (++ <mark>adc count</mark>))	d display using the LEDs */	
137	{ _	· _ //		
138 ffc00b71 139	adc	_count = 0;		
➡ 140 ffc00b7a	led_dis	<pre>play_count(adc_count);</pre>		
141	14 6			~
······································				

Figure 5-24 Execution of Event Break

Figure 5-24 shows that adc_count reaches the value of 6 (or 0x6) and the program stops at code line No.140 (right after the line of code increasing adc_count).



5.4.8 IO Registers View

IO registers are also known as the Special Function Registers (SFR). The [IO Registers] view displays all the register sets defined in a target-specific IO file, including their names, addresses, and hex and binary values. Users can further customize their own [IO registers] view by adding IO registers selectively to the [Selected Registers] pane.

Name	Value (Hex)	Value (Bin)	Addres	is	Access
✓ ○ PORT0					
> PDR	0x00	000	00000 0x0008	c000	RW
> PODR	0x00	000	00000 0x0008	c020	RW
> PIDR	0x00	000	00000 0x0008	c040	RW
> PMR	0x00	000	00000 0x0008	c060	RW
> 🛛 PCR	0x00	000	00000 0x0008	c0c0	RW
> PORT1					
All Registers Select LPeg	isters				
📘 IO Registers 🕱		E E	🗢 🔕 🎓 🔍 🛢	• 💾 🖻 🔻	
Name	Value (Hex)	Value (Bin)	Address	Access	
V O PORTO					
> • PDR	0x00		0x0008c000	RW	
> PCR	0x00	0000000	0x0008c0c0	RW	

Figure 5-25 [IO Registers] View

To view selected IO registers (e.g. PDR and PCR in PORT0),

- Click [Windows] → [Show View] → [Others...]. In the "Show View" dialog, click [IO Registers] under [Debug] or icon
 to open the [IO Registers] view.
- 2. Under the [All Registers] tab, locate [PORT0] in the [IO Registers] view. Expand the PORT0 IO register list.

You could also use the Search button ____ in the IO Register toolbar to quickly search by name.

- 3. Drag and drop the "PDR" and "PCR" to the [Selected Registers] pane. A green dot besides the IO register indicates the status of the selected register(s).
- 4. Switch to the [Selected Registers] tab to view "PDR" and "PCR" of the "PORT0" IO register.

The expanded IO register list may take a longer time to load in the [All Registers] pane. Hence, it is advisable to customize and view multiple selected IO registers from the [Selected Registers] pane.



5.4.9 Trace View

Tracing means the acquisition of bus information per cycle from the trace memory during user program execution. The acquired trace information is displayed in the [Trace] view. It helps users to track the program execution flow to search for and examine the points where problems arise.

The trace buffer is limited (with size of 1 to 32 Mbytes), the oldest trace data is overwritten with the new data after the buffer has become full.

Cons	ole 🧟 Ta	asks 🖹 Pro	oblems 🍕								
No reco	ords			17 17]⊳ □	⇒ Q, ƴ	H 😂 🤻	🚖 🖄 🐺	₩ ∀ 🙆	& U 9	\$8 2 2
Cycle	Label	Addr	Sourc	Desti	Data	Size	R/W	BUS	Туре	BCN	Branc
	e	Trace Acqu	isition						×		
	Tra	ce Mode:			Fill ur	itil stop			~		
	Tra	ce Output	:		Do no	ot output	(Internal	Buffer Us	sed) \vee		
	Tra	ce Type:			Branc	h			~		
	Tra	ce Capacit	y (frames	;):					\sim		
	Tin	nestamp F	requency	Divider:	No fr	equency	division		\sim		
	Ena	able Times	tamp Dis	play:	\checkmark						
	Bus	s Master C	f Data A	ccess:	CPU				~		
		rt address									
		ess(witho address									
		cess(witho									
						OK		Cano	el		
<										1	>

Figure 5-26 [Trace] View (1/2)



Quick Start Guide

e² studio

To set a point-to-point trace between two (2) functions (e.g. tracing from function "main()" to "R_LCD_Display()"),

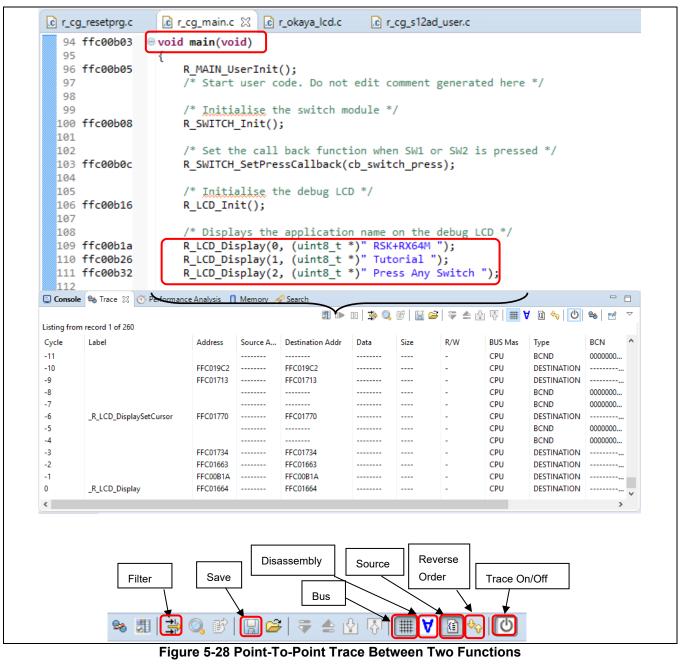
- Click [Window] → [Show View] → [Others...]. In the "Show View" dialog, click [Trace] under [Debug] or icon
 to open the [Trace] view.
- 2. Turn on the Trace view by selecting the icon.
- 3. Click icon 💷 (Acquisition) to set:
 - Trace Mode: "Fill until stop"
 - Trace Type: "Branch"
 - Bus Master Of Data Access: "CPU"
- 4. Click [OK] to proceed.

Trace		莽 🔍 🐨	🔛 😂 🛛 ኞ	鲁 🖄 🖗	Ⅲ ∀	(i) 🍫 🗍 🕐	🙈 🖻 🕚	
No record	s							
Cycle	Label	Address	Source A	Destinati	Data	Size	vw.	BUS N
1	Trace Event	points					>	<
(🏁 Start 🧧 St	op 🧉 Record						
					Т	rigger: OR	× 4 1	2
	Туре	Address	Data	Count Ti	mer Channe	el Comment		
	✓ ▲ OR	&main						
	Add Ed	lit Delete PC	C: 1/8 OA: 0/4 A	ll: 1				
						ОК	Cancel	
							Cancer	
Γ	-							
	📴 Trace Event	op 📽 Record					>	<
	Start Start	op • Record				_		
					1	frigger: OR	~ + 1	
	Туре	Address	Da	nta Co	ount Timer	Channel Com	iment	
	⊡ <u></u> ▲ OR	&R LCD Displa	ay J					
	<							
	Add Ed	lit Delete PC	C: 2/8 OA: 0/4 A	11: 2				

Figure 5-27 [Trace] View (2/2)

e² studio

- 5. Click 🏁 (Edit Trace Event Points) to open the [Trace Eventpoints] dialog box.
- 6. Under the [Start] tab, add the 1st event point at the "main()" function (by the execution address "&main").
- 7. Then, switch to the [Stop] tab and add the 2nd event point at "R_LCD_Display()" function (by the execution address "&R_LCD_Display").
- 8. Next, execute the program after reset.



The figure above shows the trace result from function "main()" to "R_LCD_Display()". The trace result can be filtered by the key trace parameters (e.g. branch type, address range) and saved to the .xml format (with the inclusion of bus, assembly and source information).

Note: The external trace feature of RX device with the E20 emulator works only through Mictor-38-pin interface. However, it is not available through the 14-pin JTAG/FINE interface, even with the E20 emulator. The RX emulator interface specifications can be downloaded at the following site.

E1/E20/E2 Emulator, E2 Emulator Lite Additional Document for User's Manual (Notes on Connection of RX Devices)

https://www.renesas.com/search?keywords=R20UT0399



5.4.10 Memory Usage View

The Memory Usage view allows users to view the total memory size, usage of ROM and RAM ratio and detailed information of sections, objects, symbols or modules, vector tables, and cross references used in a project.

To view the memory usage of a project,

- 1. Click [Window] \rightarrow [Show View] \rightarrow [Other...] \rightarrow [Debug] \rightarrow [Memory Usage] to open the Memory Usage view.
- 2. The default display of the Memory Usage view is different according to each kind of projects.
 - a. The GUI of the Memory Usage view for executable project which uses Renesas Toolchain includes 3 regions: (1) Group size region, (2) RAM/ROM Usage region and Device Memory Usage region, (3) Detail table region. The map file location is shown at the bottom bar.

Size:)	RAM/ROM U	sage Device Memo	ory Usage		
Progra Consta	nt: ed Data: ilized Data:			5819 by 1915 by 48 by 1176 by 48 by 1024 by 0 by	rte(s) rte(s) rte(s) rte(s)	ROM	Usage: <u>1 %</u> used 1 % used	552KB 4096KB	(2)	
Section										
Section	Group	Start address	End address	Size (byte)	Align	Attribute	Load address			^
SU	Stack	0x00000000	0x000000FF	256	4					
SI	Stack	0x00000100	0x000003FF	768	4					
B_1	Uninitialized D	0x00000400	0x00000483	132	1					
R_1	Data	0x00000484	0x000004A1	30	1					
B_2	Uninitialized D	0x000004A2	0x000008A9	1032	2				(2)	
0.0	Data	0x000008AA	0x000008AF	6	2				(3)	
R_2	Uninitialized D	0x000008B0	0x000008BB	12	4					
R_Z B		0x000008BC	0x000008C7	12	4					
	Data	000000000								

Figure 5-29 Executable Project - Renesas Toolchain



e² studio

b. For executable project which uses GCC Toolchain, "Memory region usage" region (2) will be displayed instead of the RAM/ROM usage region:

Size:	(1)					Memory Regi	ion Usage Device Mem	ory Usage		
Program	יי די ד			14432 by	rte(s)	Memory Reg	gion Usage:			^
Constan	t:			1520 by	rte(s)	DOM	1 %	4096KB		
Initialize	d Data:			12 by	rte(s)	ROM 15	5KB used	4096KB	(2)	
Uninitial	ized Data:			2140 by	te(s)					
Data:				0 by	rte(s)	RAM	1 % KB used	512KB		
Stack:				0 by	rte(s)	/1	KB useu			
Others:				5376 by	rte(s)	OFS	15 % 0B used	256B		
Section .ustack	Group Stack	Start addres 0x00001D68	End address	Size (byte)	Align	Attribute	Load addre			
Section	Group	Start addres	End address	Size (byte)	Align	Attribute	Load addre			^
.ustack .tors	Constant	0xFFC03DA8		0]			
.text	Program	0xFFC00000	0xFFC0385F	14432						
.rvectors	Constant	0xFFC03860	0xFFC03C5F	1024				(3)		
	Constant	0xFFC03C60	0xFFC03DA7	328						
	Others	0x00000D68	0x00001D67	4096			0xFFC04B10			
.rodata .r_bsp_ustack	Others		0x00000967	256			0xFFC04610			
.rodata .r_bsp_ustack	Others	0x0000868								
.rodata		0x00000868 0x00000968	0x00000D67	1024			0xFFC04710			~

Figure 5-30 Executable Project - GCC Toolchain

c. For a library project which uses Renesas Toolchain, "Library information view" will be displayed instead of "Group size view".

Note: Only available for Renesas CC-RX, CC-RL, or CC-RH toolchains.

Library Info	rmation:			RAM/ROM Usage Device Memory Usage
CPU: Endiar Attribu			CCRX_Lib.lib RX Little user 3	RAM/ROM Usage: Library project is not supported to show RAM/ROM usage information. (2)
Module				
MIL	Section	Symbol		
Module	becaon			
sample1				
,				
sample1				
sample1 sample2				(3)

Figure 5-31 Library Project - Renesas Toolchain



d. The Memory Usage view is not available for the library project which uses GCC Toolchain.

Group Size view:

Displays the total size of Program, Constant, Initialized Data, Uninitialized Data, Data, Stack, and Others according to the selected map file.

Note: This view only displays an executable project of supported toolchains.

Library Information view:

Displays the information of selected library list file. The information to be visualized on this region consists of: • The name of the selected library

- The type of CPU specified by the project
- Endian
- Attribute
- Number of modules.

RAM/ROM Usage region:

Shows the percentage of RAM/ROM usage by numerical value and status of bar. The color of the bar is based on the percentage value.

- If percentage < 75%: Green.
- If percentage >= 75% and percentage < 90%: Orange.
- If percentage >= 90%: Red.

Memory Region Usage region:

Displays the usage ratios for the address ranges of the memory region (memory block) of the linker script for a project that uses a GCC toolchain. The display feature of this region is similar to RAM/ROM usage region.



Device Memory Usage region:

Shows the device memory of selected project's device. Each memory area shows name, start address, end address, and the amounts of memory in use (in bytes and as percentages) relative to the whole size of the area.

🕮 Registers 🗈 Problems 🤇	🗞 Smart Browser 👒 Trace 🔋 Memory Usa	ge 🛛 🛛 Mem	nory 陷 Project Explo	orer 🏼 🤌 🦃 🍕 🕤	- 8
Size:			RAM/ROM Usage	Device Memory Usage	
Program:	5819	oyte(s)	▶ 0x00000000	InternalRam	
Constant:	1915	oyte(s)	0x0007FFFF	2248/524288 byte(s) (0.43%)	
Initialized Data:	48	oyte(s)	0x00080000		
Uninitialized Data:	1176			IoRegister 16384 byte(s)	
Data:	1	oyte(s)	0x00083FFF		
Stack:	1024		0x00084000	Non-map area	
Others:	0	oyte(s)	0x00085FFF		
			0x00086000	loRegister	
			0x000A3FFF	122880 byte(s)	
			0x000A4000	InternalRam	
			0.00045555	0/8192 byte(s) (0.00%)	~

Figure 5-32 Device Memory Usage Region

Expand memory area to see all sections. The color of sections corresponds to that of Group Size Region.

Registers 🗈 Problems 🤇	🗞 Smart Browser 👒 Trace 🔋 Memory Usage 😣 🛛 M	emory 陷 Project Explorer		se 🖉 🖗 🔊	
Size:		RAM/ROM Usage Device	Memory Usag	ge	_
Program:	5819 byte(s)	0x00000000 Interna	alRam		1
Constant:	1915 byte(s)	• 0x0007FFFF	2248/5	24288 byte(s) (0.43%)	
Initialized Data:	48 byte(s)				-
Uninitialized Data:	1176 byte(s)	0x0000000	SU	256 byte(s)	
Data:	48 byte(s)	0x00000100	SI	768 byte(s)	
Stack:	1024 byte(s)	0 x00000400	B_1	132 byte(s)	
Others:	0 byte(s)	0 x00000484	R_1	30 byte(s)	
		0 x000004A2	B_2	1032 byte(s)	
		0 x000008AA	R_2	6 byte(s)	
		Ox00008B0	В	12 byte(s)	
		Ox000008BC	R	12 byte(s)	
		Ox000008C8	Unused	522040 byte(s)	
		• 0x00080000 loRegi	ster		
		0x00083FFF		16384 byte(s)	

Figure 5-33 Expand Memory Area



Detail table region:

Displays the map file information of an active project or the opened map file.

- "Section" tab: Contains the "Linkage map" table which displays the list of Sections analyzed from the map file and its detailed information.
- "Object" tab: Contains the "Object" table which displays the list of Objects analyzed from the map file and its detailed information.
- "Symbol" tab: Contains the "Symbol" table which displays the list of Symbols analyzed from the map file and its detailed information.
- "Vector" tab: Displays the vector table information that is retrieved from the map file. This tab is only
 available for an executable project that is configured to work with Renesas CC-RX/CC-RL/CC-RH
 toolchains.
- "Cross Reference" tab: Displays the cross reference information that is retrieved from the map file. This tab is only available for an executable project.
- "Module" tab: Contains the "Module" table. This tab is only available for a library project that is configured to work with Renesas CC-RX/CC-RL/CC-RH toolchains.

Map file location:

Displays the information of the map file (*.map) or library list file (*.lbp) from a project. Users can see the relative path of the selected map file or library list file at the bottom of the Memory Usage view.



6. Help

The help system allows users to browse, search, bookmark and print help documentation from a separate Help window or Help view within the workbench. Users can also access an online forum dedicated to the e² studio from here.

<u>H</u> elp	2		
3	Welcome	(1)	
? %	Help Contents Search	(2)	
	Show Contextual Help	(3)	
	Show Active Keybindings		Ctrl+Shift+L
	Cheat Sheets		
	CMSIS Pack Information		>
	RA Helpdesk		
	Synergy Helpdesk		
	Synergy License		
R 99 ~3	RenesasRulz Community Forum Add Renesas Toolchains Perform Setup Tasks	(4)	
R	Check for Updates		
\$.	Install New Software		
	Renesas e2 studio feedback		
2	IAR Embedded Workbench plugin n	nanager	
0	About e ² studio		

Click on the [Help] tab to open the Help menu.

Figure 6-1 Help – Help Menu

Quick Help Tips:

- (1) Click [Welcome] for an overview of the e² studio and to view Release Notes.
- (2) Click [Help Contents] to open a separate Help window with a search function.

There are many useful topics under [Help Contents]. For example, the "Debugging Projects" topic provides useful information such as debug configuration, supported number of breakpoints, etc. It can be launched by clicking on the [Help] menu \rightarrow [Help Contents] \rightarrow "e2 studio User Guide".

(3) Click [Show Contextual Help] to open the Help view within the workbench.

(4) Click [RenesasRulz Community Forum] to go to an online forum that is dedicated to topics and discussions related to the e² studio (Internet connection is required).



Rev.	Date	Description	
		Page	Summary
1.00	Jun.21.23	-	First edition for RX, RL78, RH850 based on e ² studio 2023-04 issued.
1.10	Mar.26.24	-	Updated installation procedure as the latest e ² studio version. Added descriptions of RISC-V MCU.
1.20	Feb.28.25	-	Updated the version numbers for supported operating systems. Added statements regarding DA devices.

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