User's Manual

CubeSuite+ V2.01.00

Integrated Development Environment

User's Manual: RL78 Design

Target Device
RL78 Family

Renesas Electronics
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How to Use This Manual

This manual describes the role of the CubeSuite+ integrated development environment for developing applications and systems for RL78 family, and provides an outline of its features.

CubeSuite+ is an integrated development environment (IDE) for RL78 family, integrating the necessary tools for the development phase of software (e.g. design, implementation, and debugging) into a single platform.

By providing an integrated environment, it is possible to perform all development using just this product, without the need to use many different tools separately.

Readers

This manual is intended for users who wish to understand the functions of the CubeSuite+ and design software and hardware application systems.

Purpose

This manual is intended to give users an understanding of the functions of the CubeSuite+ to use for reference in developing the hardware or software of systems using these devices.

Organization

This manual can be broadly divided into the following units.

CHAPTER 1 GENERAL
CHAPTER 2 FUNCTIONS (Pin Configurator)
CHAPTER 3 FUNCTIONS (Code Generator)
APPENDIX A WINDOW REFERENCE
APPENDIX B OUTPUT FILES
APPENDIX C API FUNCTIONS

How to Read This Manual

It is assumed that the readers of this manual have general knowledge of electricity, logic circuits, and microcontrollers.

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Active low representation:	$\overline{\text{XXX}}$ (overscore over pin or signal name)
Note:	Footnote for item marked with Note in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeric representation:	Decimal ... XXXX
	Hexadecimal ... 0xXXXX

Related Documents

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name		Document No.
CubeSuite+ Integrated Development Environment User's Manual	Start	R20UT2682E
	RX Design	R20UT2683E
	V850 Design	R20UT2134E
	R8C Design	R20UT2135E
	RL78 Design	This manual
	78K0R Design	R20UT2137E
	78K0 Design	R20UT2138E
	RH850 Coding	R20UT2584E
	RX Coding	R20UT2470E
	V850 Coding	R20UT0553E
	Coding for CX Compiler	R20UT2659E
	R8C Coding	R20UT0576E
	RL78, 78K0R Coding	R20UT2140E
	78K0 Coding	R20UT2141E
	RH850 Build	R20UT2585E
	RX Build	R20UT2472E
	V850 Build	R20UT0557E
	Build for CX Compiler	R20UT2142E
	R8C Build	R20UT0575E
	RL78, 78K0R Build	R20UT2143E
	78K0 Build	R20UT0783E
	RH850 Debug	R20UT2685E
	RX Debug	R20UT2702E
	V850 Debug	R20UT2446E
	R8C Debug	R20UT0770E
	RL78 Debug	R20UT2445E
	78K0R Debug	R20UT0732E
	78K0 Debug	R20UT0731E
	Analysis	R20UT2686E
	Message	R20UT2687E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest edition of each document when designing.

TABLE OF CONTENTS

CHAPTER 1 GENERAL

CubeSuite+ is an integrated development environment used to carry out tasks such as design, coding, build and debug for developing application systems.

This chapter gives an overview of the design tool (Pin Configurator/Code Generator).

1.1 Overview

The design tool, which is one of the components provided by CubeSuite+, enables you to output the pin assignment of the microcontroller (device pin list and device top view), and the source code (device driver programs, C source files and header files) necessary to control the peripheral functions (clock generator, port functions, etc.) provided by the microcontroller by configuring various information using the GUI.

1.2 Features

The design tool (Pin Configurator/Code Generator) has the following features.

- Code generating function
  The Code Generator can output not only device driver programs in accordance with the information configured using the GUI, but also a build environment such as sample programs containing main functions and link directive files.

- Reporting function
  You can output configured information using the Pin Configurator/Code Generator as files in various formats for use as design documents.

- Renaming function
  The user can change default names assigned to the files output by the Code Generator and the API functions contained in the source code.

CHAPTER 2 FUNCTIONS (Pin Configurator)

This chapter describes the key functions provided by the design tool (Pin Configurator) along with operation procedures.

Remark In this chapter, an example where an RL78/G13 (ROM: 16KB) R5F1006A(20pin) is the target device is used to explain the key functions.

2.1 Overview

The Pin Configurator is used to output report files such as a device pin list and a device top view by entering pin assignment information of the microcontroller.

The following sections describe the operation procedures for Pin Configurator.

(1) Start CubeSuite+

Launch CubeSuite+ from the [Start] menu of Windows.

Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Start CubeSuite+".

(2) Create/Open project

Create a new project (that defines a kind of project, microcontroller to be used, build tools to be used, etc.) or load an existing project.

Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Create/Open project".

(3) Open Device Pin List Panel

Open the Device Pin List panel, where you enter information on the pins of the microcontroller.

(a) Select item

Allows you to select items displayed in the device pin list.

(b) Change display order

Allows you to change the order in which items are displayed in the device pin list.

(c) Add column

Allows you to add columns to the device pin list.

(d) Delete column

Allows you to delete columns from the device pin list.

(4) Open Device Top View Panel

Open the Device Top View panel, where you can confirm the information entered for the pins.

(a) Select shape of microcontroller

Allows you to select the shape of the microcontroller displayed in the Device Top View panel.

(b) Select color

Allows you to select colors used to distinguish the type of pins (power pins, special pins, used pins, etc.) whose information is displayed in the Device Top View panel.

(c) Select popup information

Allows you to select the type of information that popups when you move the mouse cursor over each pin in the Device Top View panel.

(d) Select additional information

Select the type of information to display in Pin area of the Device Top View panel.

(5) Enter Information

Enter information on the pins of the microcontroller in the Device Pin List panel.

(6) Output Report Files

Output report files (files containing configured information using Pin Configurator: device pin list and device top view) to the specified folder.

(a) Output device pin list

Output a device pin list.

(b) Output device top view

Output a device top view.

(7) Save project

Save a project.

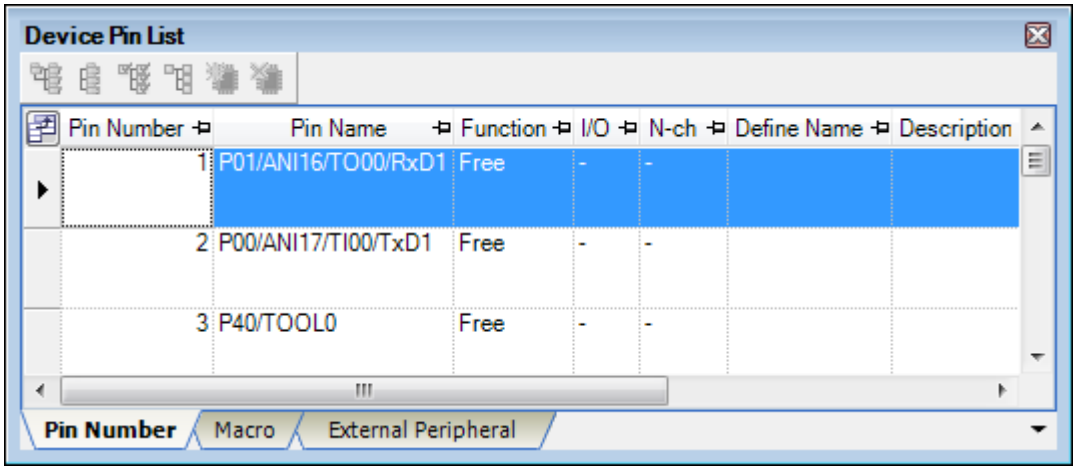
Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Save project".

2.2 Open Device Pin List Panel

Open the Device Pin List panel, where you enter information on the pins of the microcontroller.

To open the Device Pin List panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List] in the Project Tree panel.

Figure 2-1. Open Device Pin List Panel



Remarks 1. If an unsupported microcontroller is defined in the project for Pin Configurator, then "[Pin Configurator (Design Tool)] node" will hide under [*Project name* (Project)] in the Project Tree panel.

2. The Device Pin List panel consists of three tabs. Selecting one of the tabs changes the order in which "information on each pin of the microcontroller" is displayed.

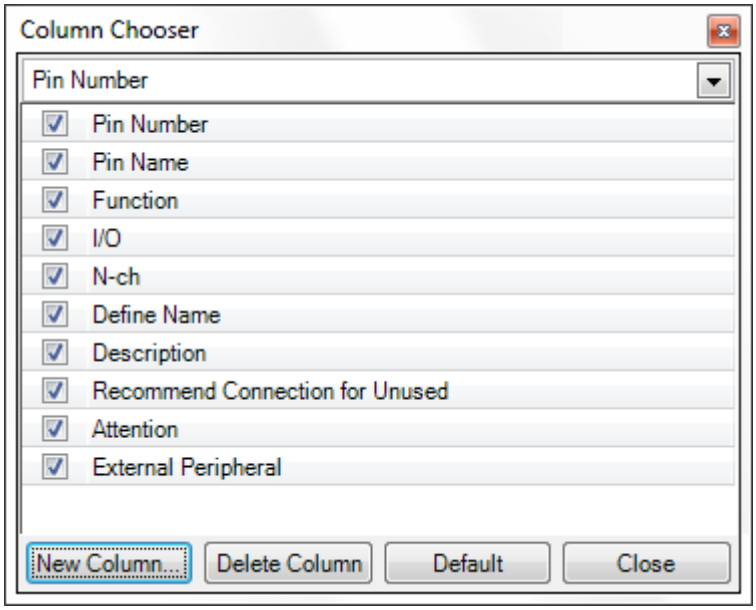
- [Pin Number] tab
  Information on each pin of the microcontroller is displayed in the order of pin number.
- [Macro] tab
  Information on each pin of the microcontroller is displayed in the order it was grouped into peripheral functions.
- [External Peripheral] tab
  Information about the pins connected to external peripherals is displayed in order grouped at the external-peripheral component level.

2.2.1 Select item

The Pin Configurator is used to select items to be displayed in the device pin list using the button in the upper left corner of the device pin list.

To select the item to be displayed, use the Column Chooser dialog box that opens by pressing the button in the upper left corner of the device pin list.

Figure 2-2. Select Item



Remark To select the item to be displayed, check the check box that corresponds to the item.

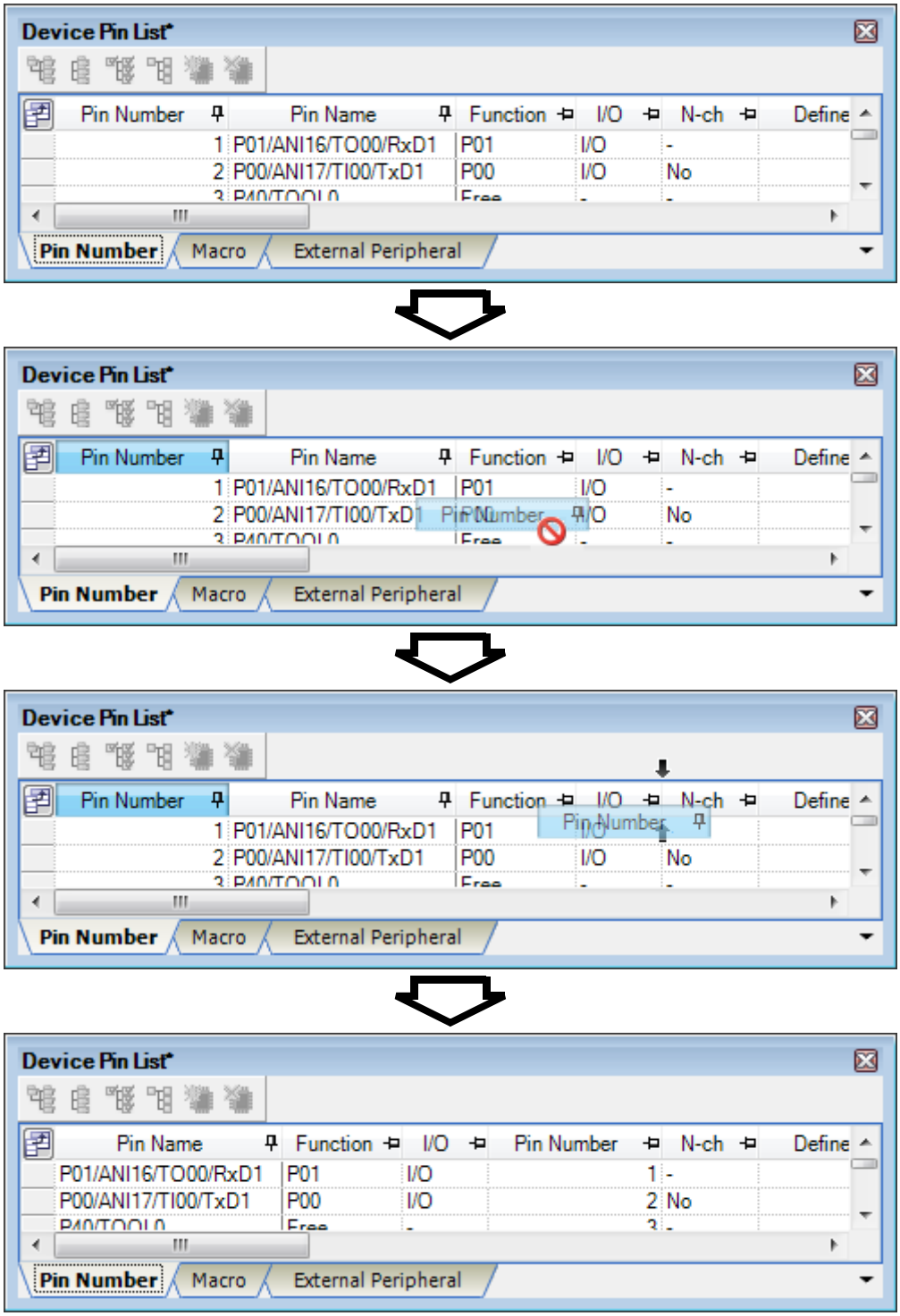
Table 2-1. Select Item

Checked	Displays the selected item in the device pin list.
Not checked	Hides the selected item in the device pin list.

2.2.2 Change display order

In Pin Configurator, you can change the display order of columns in the device pin list (move columns) by dragging and dropping columns.

Figure 2-3. Change Display Order



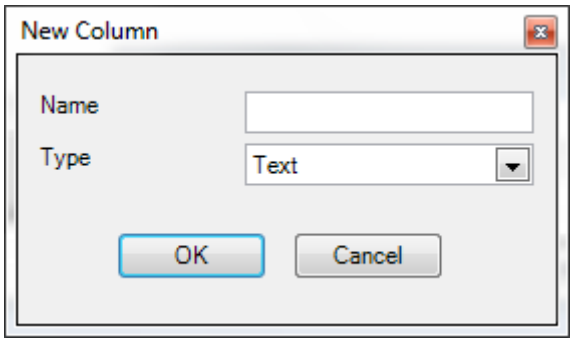
Remark To change the display order, click the button in the upper left of the device pin list. The Column Chooser dialog box opens. Drag an item displayed in the dialog's select Items to display area, and drop it to the desired destination in the device pin list. This will change the display order.

2.2.3 Add column

The Pin Configurator is used to add the "user's own column" to the device pin list using the [New Column...] button in the Column Chooser dialog box that opens by pressing the button in the upper left corner of the device pin list.

To add a column, use the New Column dialog box that opens by pressing the [New Column...] button in the Column Chooser dialog box.

Figure 2-4. Add Column



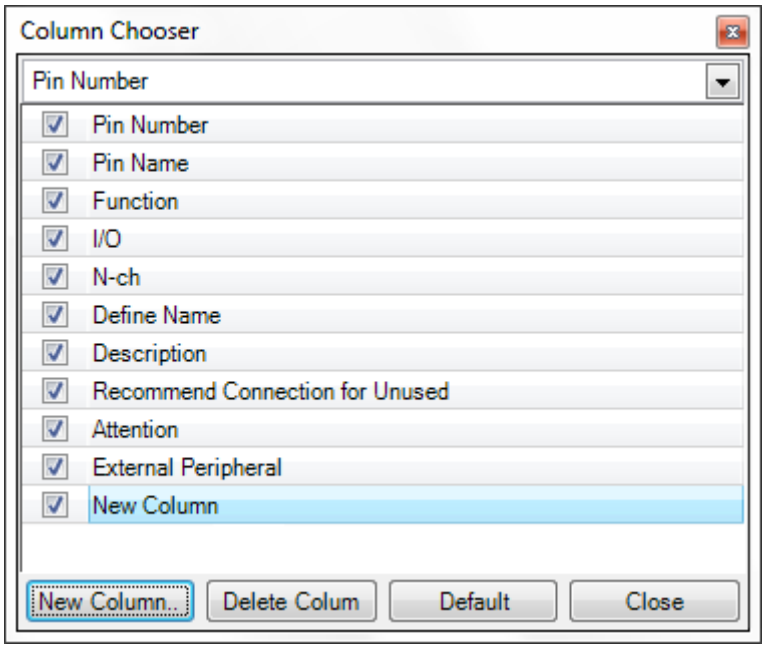
Remark On the device pin list, adding columns to the first level of [Macro] tab, [External Peripheral] tab is restricted.

2.2.4 Delete column

The Pin Configurator is used to delete the "user's own column" from the device pin list using the [Delete Column] button in the Column Chooser dialog box that opens by pressing the button in the upper left corner of the device pin list.

To delete a column, select the column you want to delete in the displayed item selection area of the Column Chooser dialog box, and press the [Delete Column] button.

Figure 2-5. Delete Column



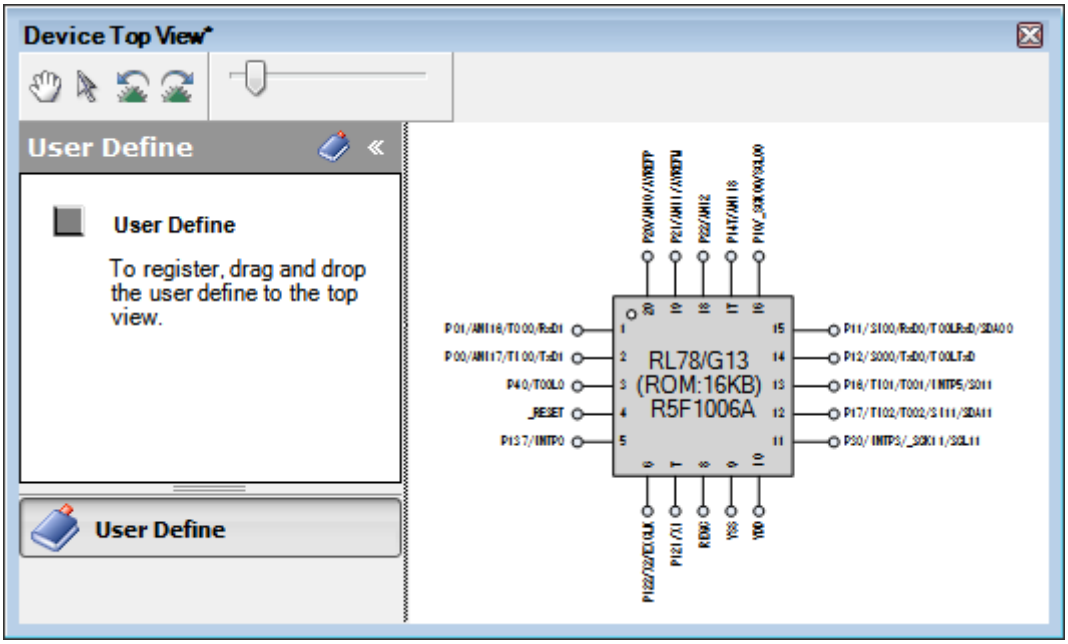
Remark You can only delete the column which you added using the New Column dialog box.

2.3 Open Device Top View Panel

Open the Device Top View panel, where you can confirm the information entered for the pins of the microcontroller.

To open the Device Top View panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View] in the Project Tree panel.

Figure 2-6. Open Device Top View Panel



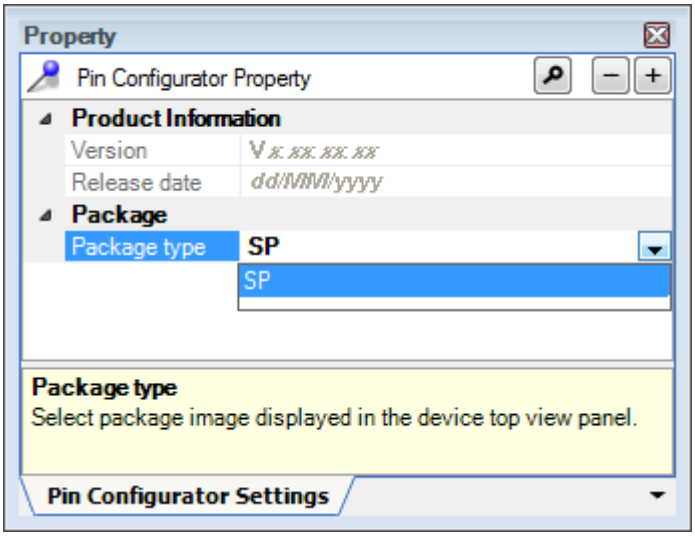
Remark In the Property panel, on the [Pin Configurator Settings] tab, if "BGA" is selected for the Package type, then Device Top View panel cannot be opened.

2.3.1 Select shape of microcontroller

Select the shape of the microcontroller displayed in the Device Top View panel which is opened as described in "2.3 Open Device Top View Panel".

To select the shape of the microcontroller, click [Pin Configurator Settings] tab >> [Package] >> [Package type] in the Property panel and select the desired shape.

Figure 2-7. Select Shape of Microcontroller



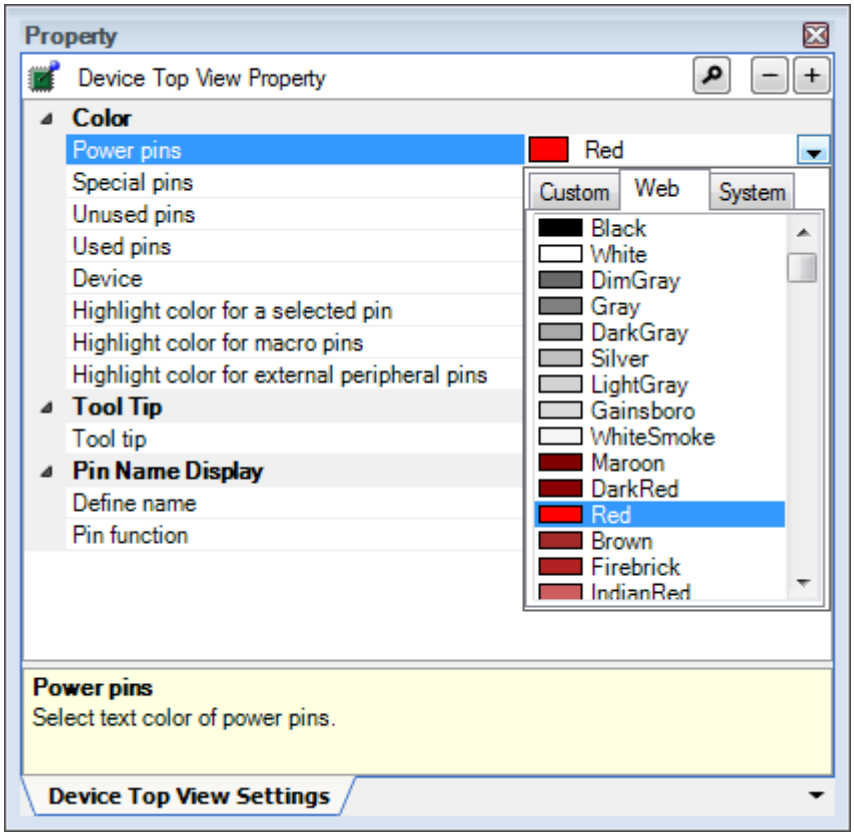
Remark Selection of the shape of the microcontroller is made using the order name (such as GC and GF).

2.3.2 Select color

Select the colors used to distinguish the type of pins (power pins, special pins, unused pins, etc.) whose information is displayed in the Device Top View panel which is opened as described in "2.3 Open Device Top View Panel".

To select the color to be displayed, click [Device Top View Settings] tab >> [Color] in the Property panel and select the color.

Figure 2-8. Select Color



Remark Select the colors to be displayed for the following eight types of items.

Table 2-2. Select Color

Item	Outline
Power pins	Selects the display color for power pins (pins whose use is limited to power).
Special pins	Selects the display color for special pins (pins with specified uses).
Unused pins	Selects the display color for unused pins (dual-use pins with no use set in the Device Pin List panel).
Used pins	Selects the display color for used pins (dual-use pins with a use set in the Device Pin List panel).
Device	Selects the display color of the microcontroller.
Highlight color for a selected pin	Selects the background color of a pin selected in the Device Pin List panel, on the [Pin Number] tab.

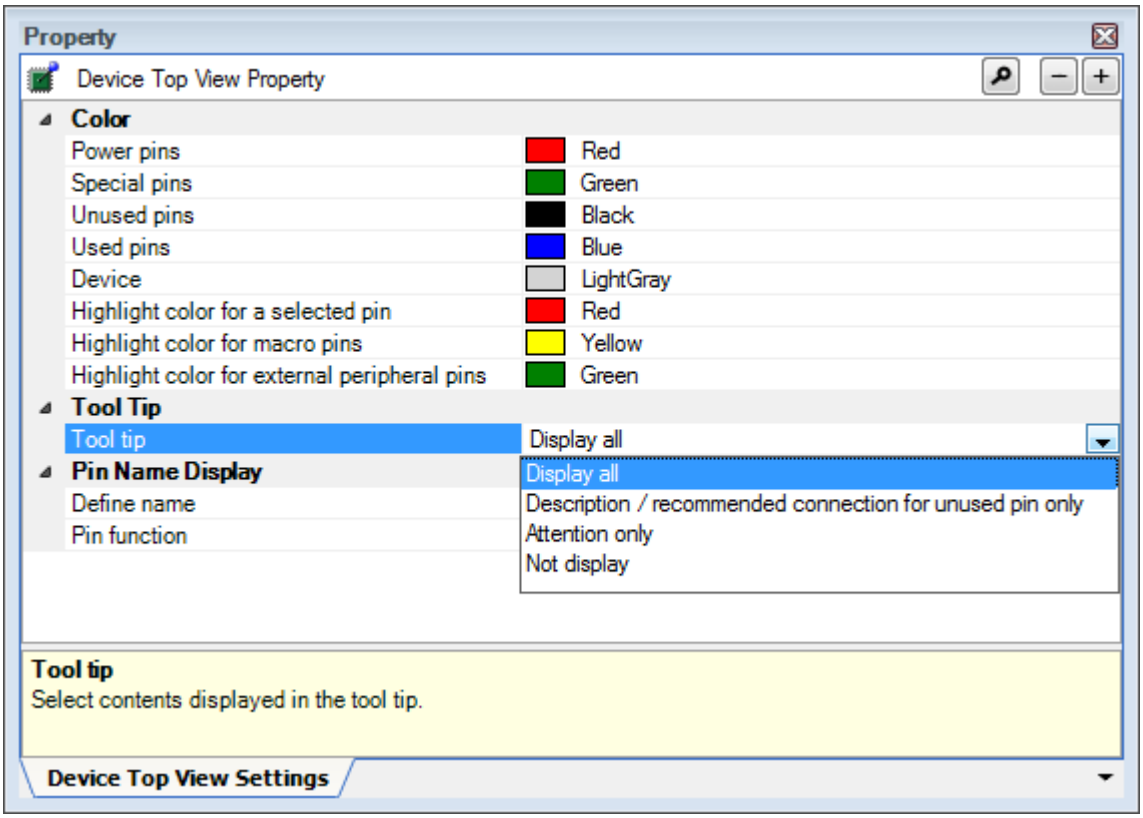
Item	Outline
Highlight color for macro pins	Selects the background color of pins selected in the Device Pin List panel, on the [Macro] tab.
Highlight color for external peripheral pins	Selects the background color of pins selected in the Device Pin List panel, on the [External Peripheral] tab.

2.3.3 Select popup information

Select the type of information that popups when you move the mouse cursor over each pin in the Device Top View panel which is opened as described in "2.3 Open Device Top View Panel".

To select the popup information, click [Device Top View Settings] tab >> [Tool Tip] >> [Tool tip] in the Property panel and select the desired type of information.

Figure 2-9. Select Popup Information



Remark Popup information is selected from the following four types.

Table 2-3. Select Popup Information

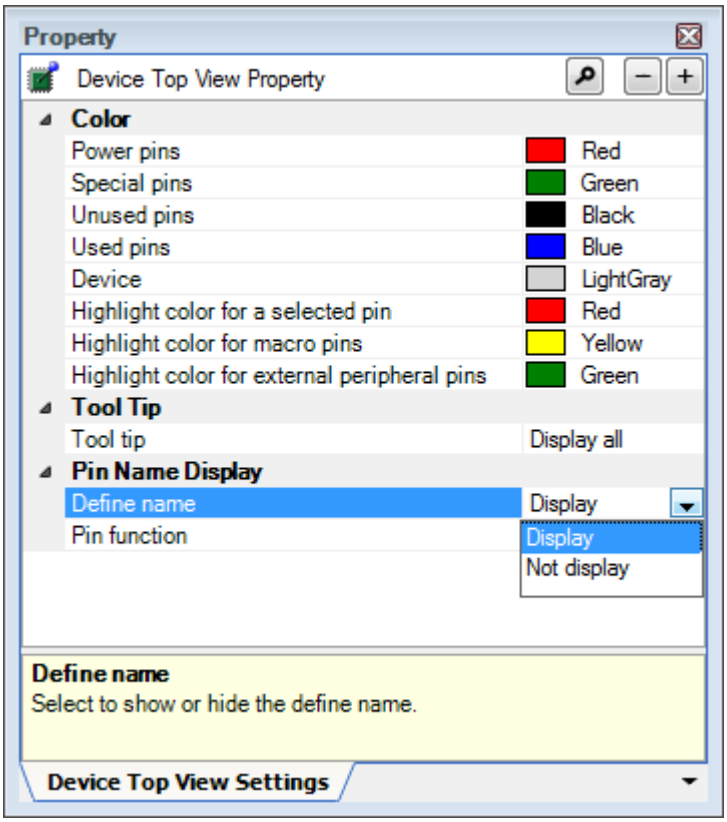
Popup Information	Outline
Display all	Displays the "Description", "Recommend Connection for Unused", and "Attention" strings for the device pin list.
Description / recommended connection for unused pin only	Displays the "Description", and "Recommend Connection for Unused" strings for the device pin list.
Attention only	Displays the "Attention" string for the device pin list.
Not display	Hides tooltips when the mouse cursor hovers over a pin.

2.3.4 Select additional information

Select the type of information to display in Pin area, in the Device Top View panel opened in "2.3 Open Device Top View Panel".

Note that additional information is selected from the Property panel, on the [Device Top View Settings] tab, by selecting the corresponding information under [Pin Name Display].

Figure 2-10. Select Additional Information



Remarks 1. Select one of the following two types for Define name (whether to display the "Define Name" string of the Device Pin List in appended format).

Display	Displays the "Define Name" string of the device pin list in appended format.
Not display	Hides the "Define Name" string of the device pin list.

2. Select one of the following two types for Pin function (whether to display it whether or not a function is selected for "Function" on the Device Pin List).

Display all	Displays functions selected via the device pin list's "Function" feature in parentheses.
Selected function only	Only display functions selected via the device pin list's "Function" feature in the device top view.

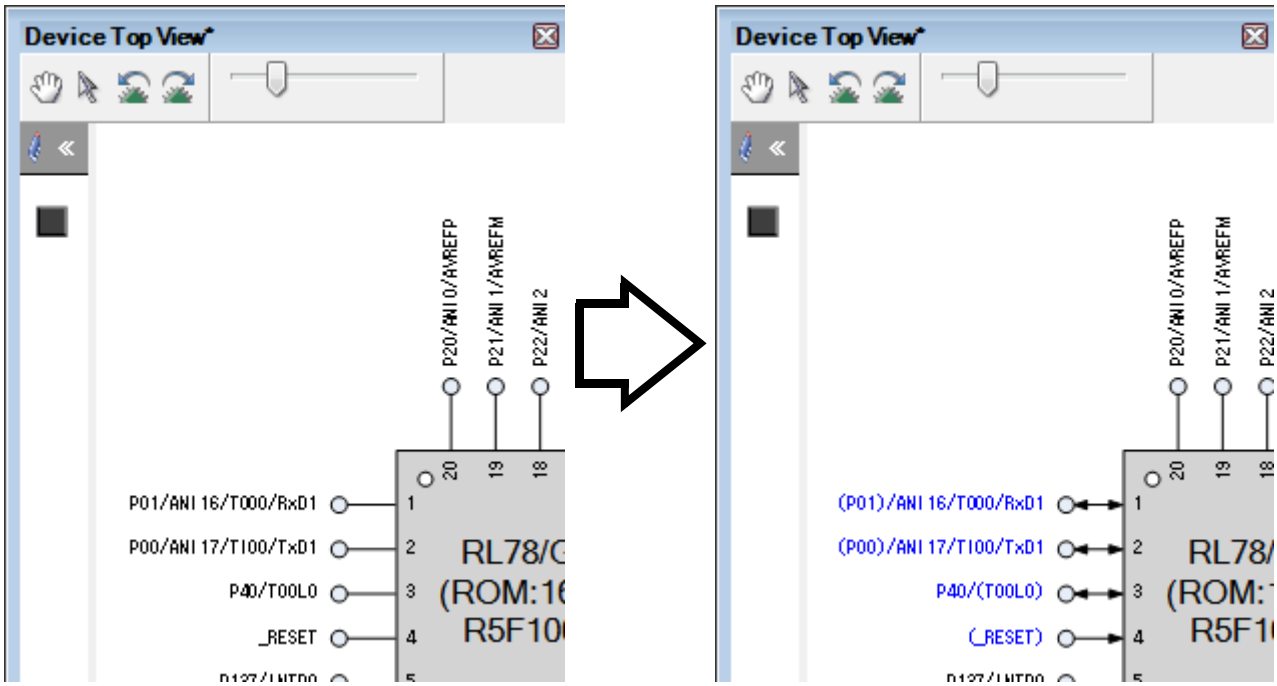
2.4 Enter Information

Enter information on the pins of the microcontroller in the Device Pin List panel which is opened as described in "2.2 Open Device Pin List Panel".

Remarks 1. You cannot add information in the "Pin Number" column, "Pin Name" column, "Description" column, "Recommend Connection for Unused" column and "Attention" column because they contain fixed information.

2. If the "Free" in the "Function" column is changed to a specific pin name, color of the corresponding pin in the Device Top View panel changes from the "color representing the unused pins" to the "color representing the used pins" selected by clicking [Device Top View Settings] tab >> [Color] in the Property panel.

Figure 2-11. Change in Displayed Color



2.5 Output Report Files

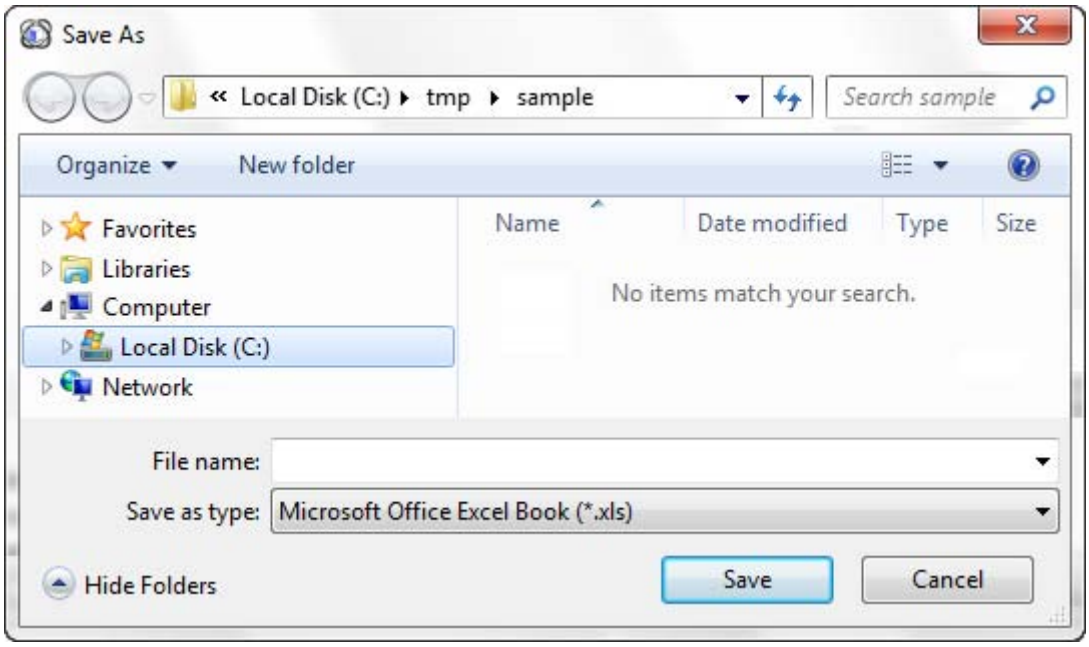
Output report files (files containing information configured using Pin Configurator: device pin list and device top view) to the specified folder.

2.5.1 Output device pin list

Select [File] menu >> [Save Pin List As...] to output a report file (a file containing information configured using Pin Configurator: device pin list).

The destination folder for the device pin list is specified in the Save As dialog box which opens by selecting [File] menu >> [Save Pin List As ...].

Figure 2-12. Output Device Pin List



Remarks 1. If a device pin list has been already output, that list will be overwritten by selecting [File] menu >> [Save Pin List].

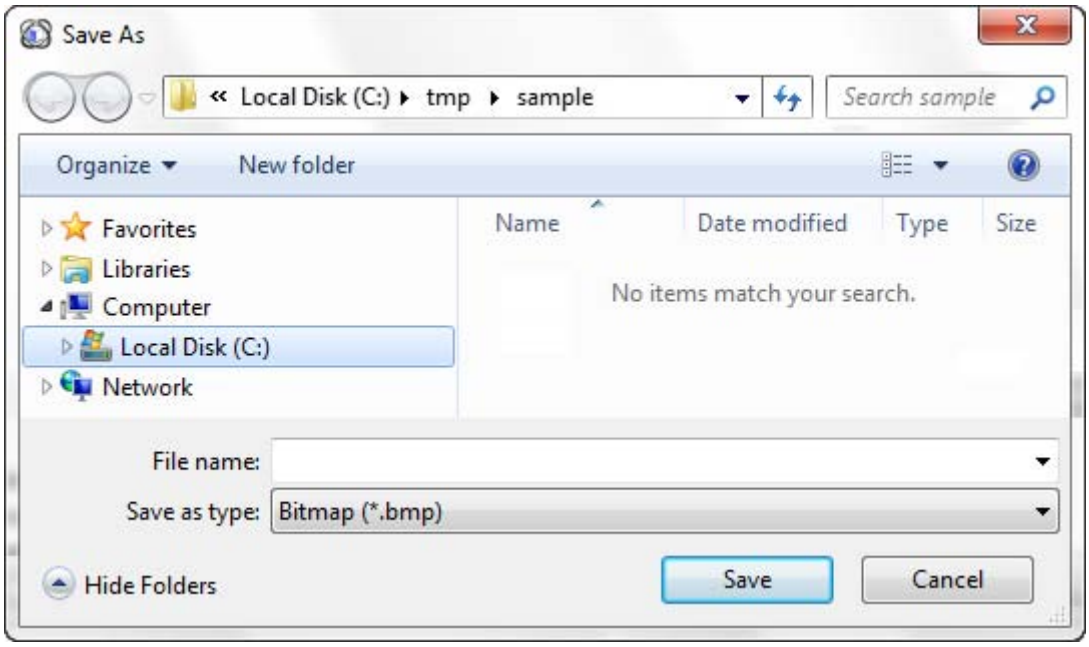
2. The output format for the device pin list is limited to Microsoft Office Excel Book.

2.5.2 Output device top view

Select [File] menu >> [Save Top View As...] to output a report file (a file containing information configured using Pin Configurator: device top view).

The destination folder for the device top view is specified in the Save As dialog box which opens by selecting [File] menu >> [Save Top View As ...].

Figure 2-13. Output Device Top View



Remark If a device top view has been already output, that view will be overwritten by selecting [File] menu >> [Save Top View].

CHAPTER 3 FUNCTIONS (Code Generator)

This chapter describes the key functions provided by the design tool (Code Generator) along with operation procedures.

Remark In this chapter, an example where an RL78/L13 (ROM: 128KB) R5F10/WMG(80pin) is the target device is used to explain the key functions.

3.1 Overview

The Code Generator outputs source code (device driver programs) based on information selected/entered on CubeSuite+ panels that is needed to control the peripheral functions (clock generator, port functions, etc.) provided by the device.

The following sections describe the operation procedures for Code Generator.

(1) Start CubeSuite+

Launch CubeSuite+ from the [Start] menu of Windows.

Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Start CubeSuite+".

(2) Create/Open project

Create a new project (that defines a kind of project, device to be used, build tools to be used, etc.) or load an existing project.

Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Create/Open project".

(3) Open Peripheral Functions Panel

Open the Peripheral Functions panel used to configure the information necessary to control the peripheral functions (clock generator, port functions, etc.).

(4) Enter Information

Configure the information necessary to control the peripheral functions (clock generator, port functions, etc.) in the Peripheral Functions panel.

(5) Confirm Source Code

Confirm the source code (device driver program) that reflects the information configured in the Peripheral Functions panel.

(6) Output Source Code

Output the source code (device driver program) to the specified folder.

(7) Output Report Files

Output report files (a file containing information configured using Code Generator and a file containing information regarding the source code) to the specified folder.

(8) Save project

Save a project.

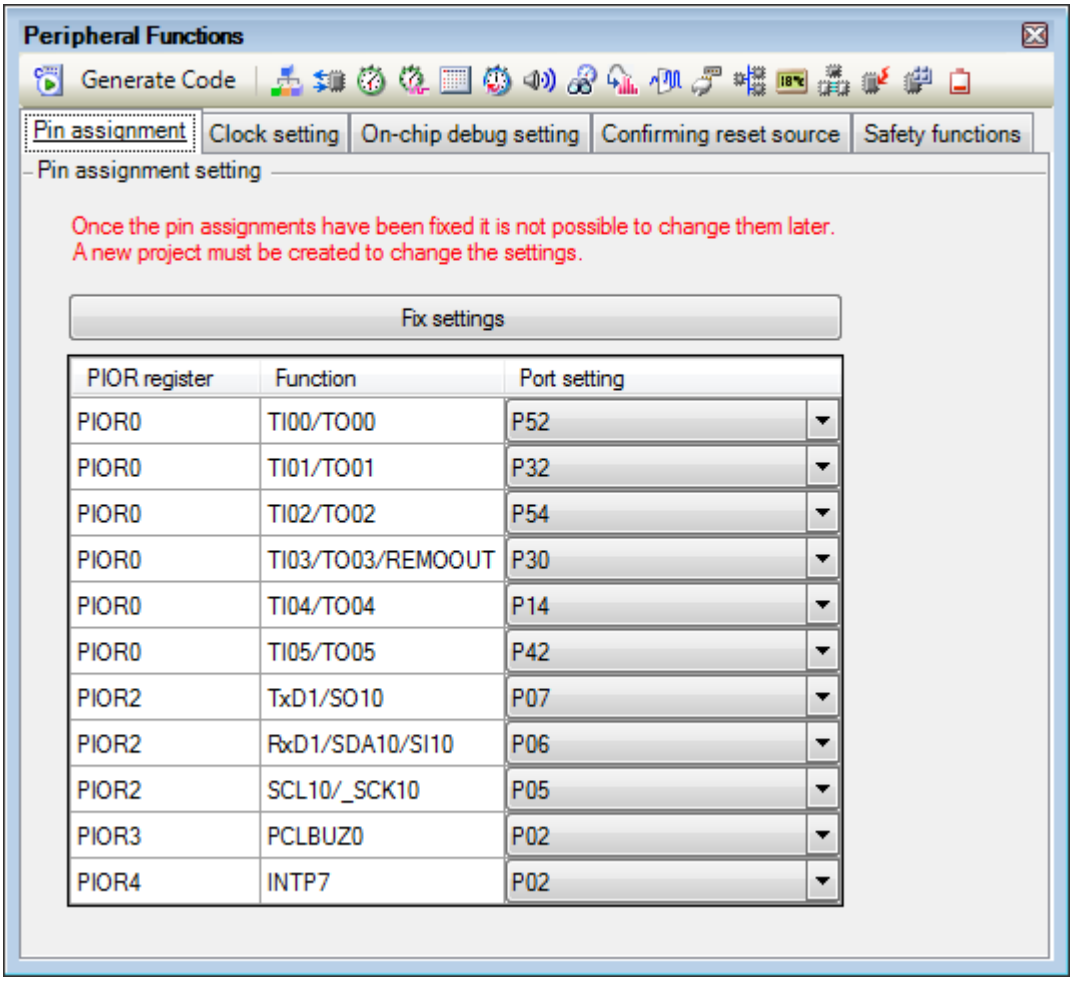
Remark See "CubeSuite+ Integrated Development Environment User's Manual: Start" for details on "Save project".

3.2 Open Peripheral Functions Panel

The Peripheral Functions panel is opened to set the information necessary to control the peripheral functions (clock generator, pin functions, etc.) provided in the device.

To open the Peripheral Functions panel, double-click [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] (>> Peripheral function node) in the Project Tree panel.

Figure 3-1. Open Peripheral Functions Panel



Remark If an unsupported device is defined in the project for Code Generator, then "[Code Generator (Design Tool)] node" will hide under [*Project name* (Project)] in the Project Tree panel.

3.3 Enter Information

Configure the information necessary to control the peripheral functions (clock generator, port functions, etc.) in the information setting area of the Peripheral Functions panel which is opened as described in "3.2 Open Peripheral Functions Panel".

Remark When controlling multiple peripheral functions, repeat the procedures described in "3.2 Open Peripheral Functions Panel" through "3.3 Enter Information".

3.3.1 Input rule

Following is the rules for input to the Peripheral Functions panel.

(1) Character set

Character sets that are allowed to input are as follows.

Table 3-1. List of Character Set

Character Set	Outline
ASCII	1-byte alphabet, number, symbol
Shift-JIS	2-byte alphabet, number, symbol, Hiragana, Katakana, Kanji and 1-byte Katakana
EUC-JP	2-byte alphabet, number, symbol, Hiragana, Katakana, Kanji and 1-byte Katakana
UTF-8	2-byte alphabet, number, symbol, Hiragana, Katakana, Kanji (include Chinese character) and 1-byte Katakana

(2) Number

Notations allowed when entering numbers are as follows.

Table 3-2. List of Notation

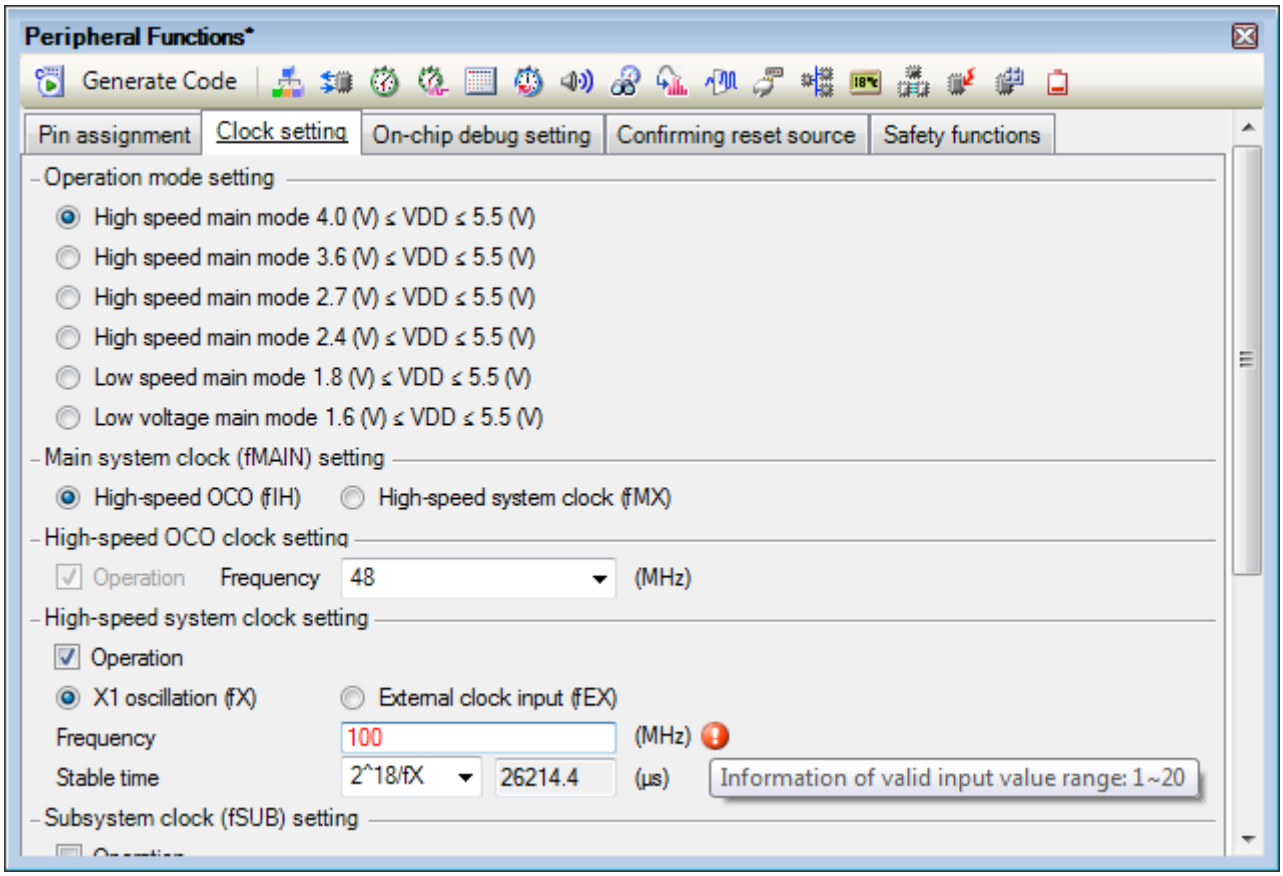
Notation	Outline
Decimal number	A numeric value that starts with a number between 1 and 9 and followed by numbers between 0 and 9, and the numeric value 0
Hex number	A numeric value that starts with 0x and followed by a combination of numbers from 0 to 9 and characters from A to F (characters are not case sensitive)

3.3.2 Icon indicating incorrect entry

When performing code generation, if you enter an invalid string in the Peripheral Functions panel, or a required input is missing, then a icon displays next to the incorrect input, and the text is displayed in red to warn that there is a problem with the input.

Remark If the mouse cursor is moved over the icon, information regarding the string that should be entered (tips for correcting the entry) popups.

Figure 3-2. Icon Indicating Incorrect Entry

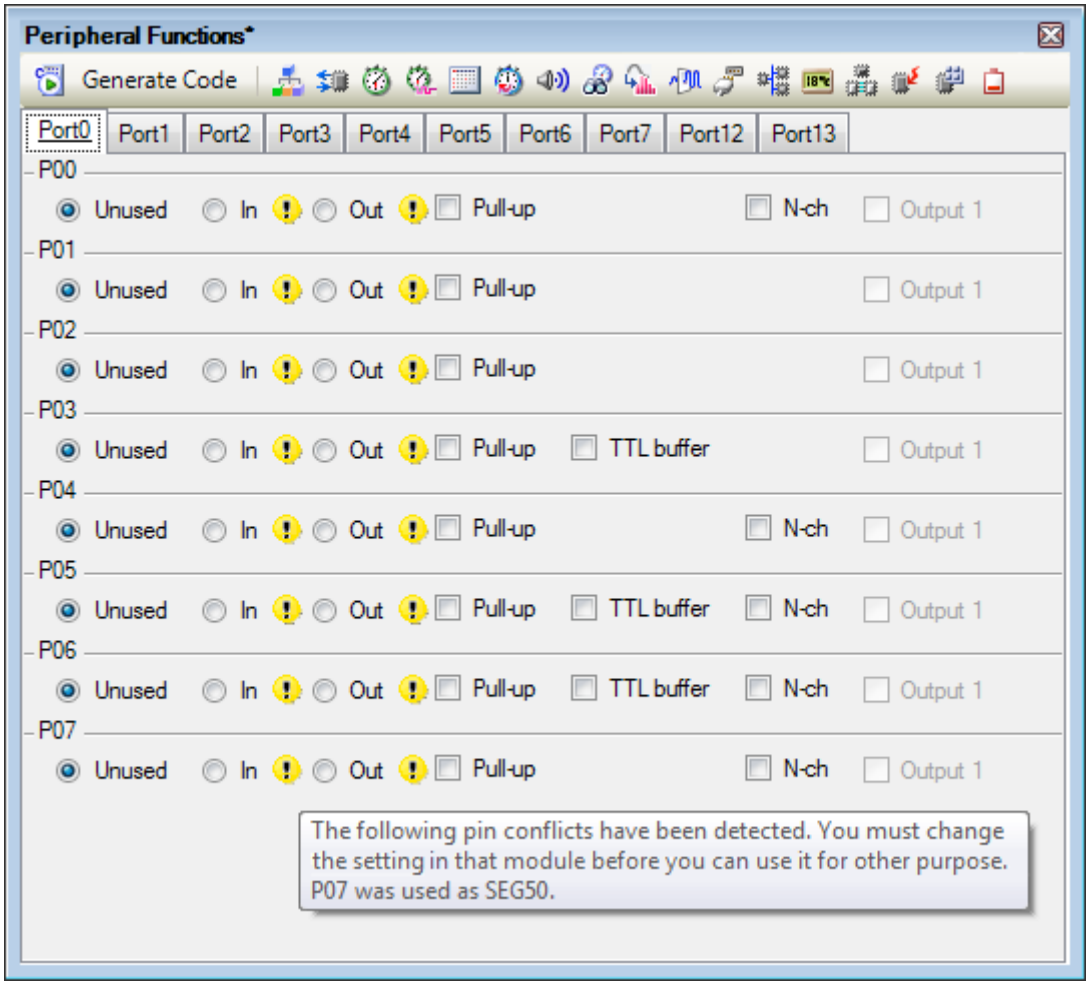


3.3.3 Icon indicating pin conflict

If a conflict occurs between the pins while setting various peripheral functions in the Peripheral Functions panel, the icon is displayed at the location where the conflict occurs to warn the user of a conflict between the pins.

Remark If the mouse cursor is moved over the icon, information regarding the conflict between the pins (tips for avoiding the conflict) popups.

Figure 3-3. Icon Indicating Pin Conflict

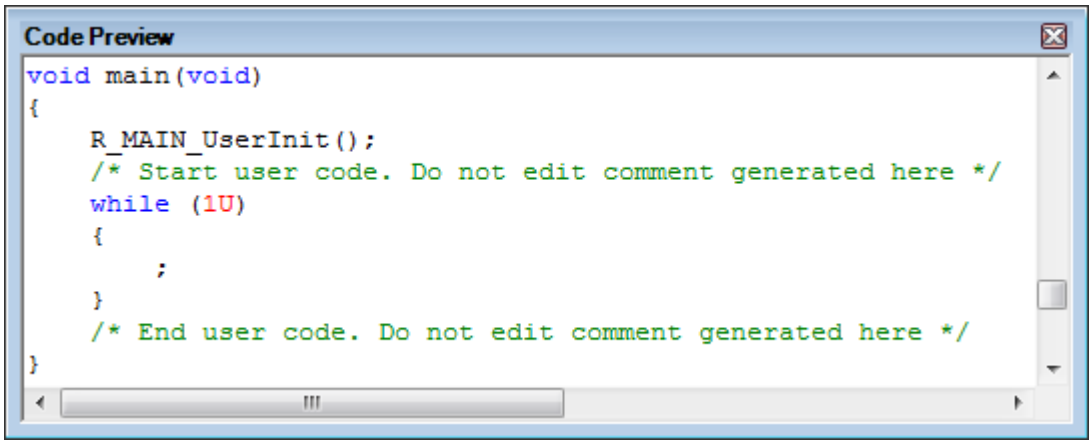


3.4 Confirm Source Code

Confirm the source code (device driver program) that reflects the information configured as described in "3.3 Enter Information".

To confirm the source code, use the Code Preview panel that opens by double-clicking [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node (>> API function node) in the Project Tree panel.

Figure 3-4. Confirm Source Code



Remarks 1. You can change the source code to be displayed by selecting the source file name or API function name in the Project Tree panel.

2. The following table displays the meaning of the color of the source code text displayed in the Code Preview panel.

Table 3-3. Color of Source Code

Color	Outline
Green	Comment
Blue	Reserved word for C compiler
Red	Numeric value
Black	Code section
Gray	File name

3. You cannot edit the source code within the Code Preview panel.

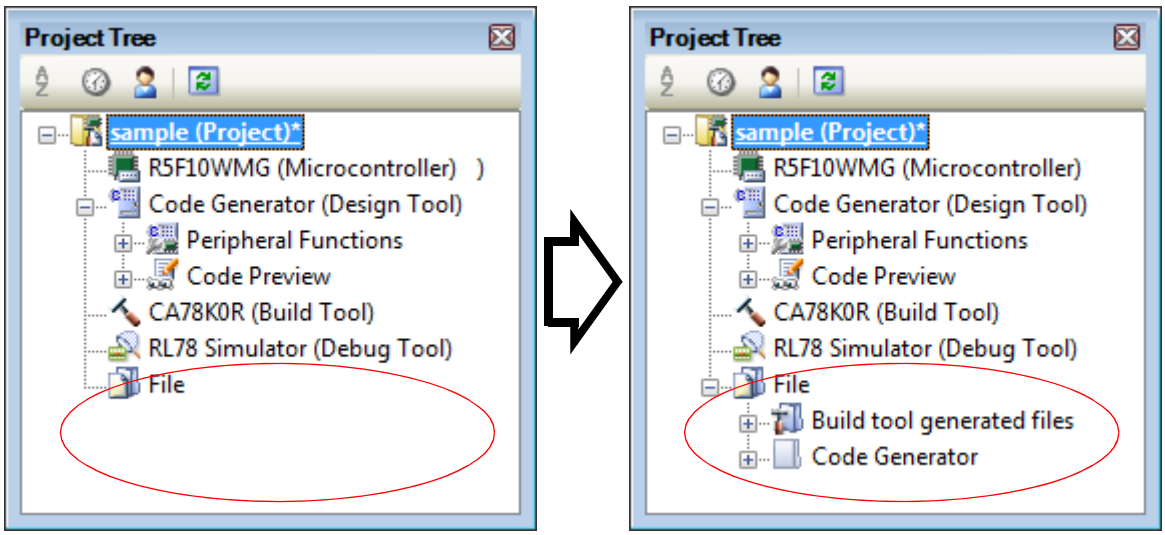
4. For some of the API functions, values such as the register value are calculated and finalized when the source code is generated (when the Generate Code button on the Peripheral Functions panel is pressed). For this reason, the source code displayed in this panel may not be the same as that would actually be generated.

3.5 Output Source Code

Output the source code (device driver program) by pressing the Generate Code button on the Peripheral Functions panel.

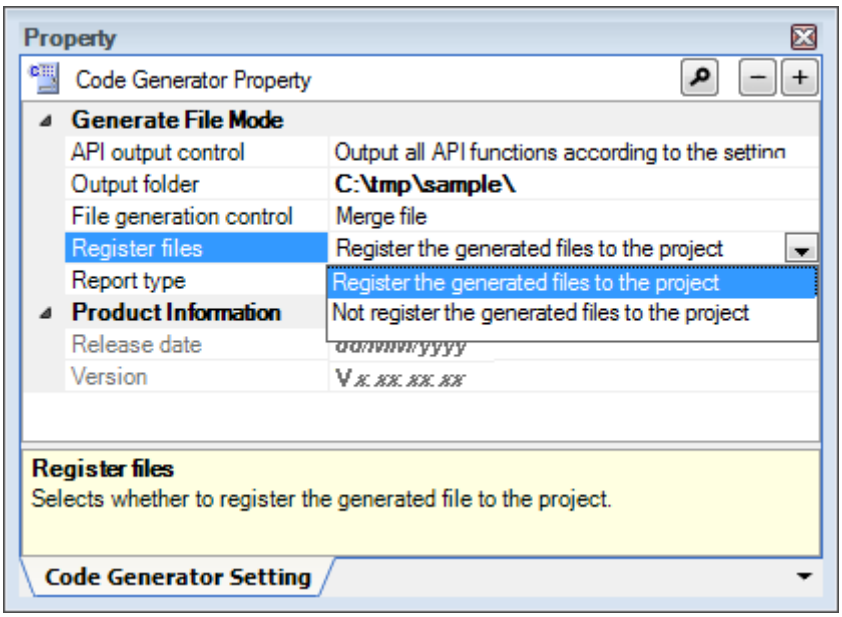
The destination folder for the source code is specified by clicking [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.

Figure 3-5. Output Source Code



Remark In order to both output source files and add them to the project (display the corresponding source file names in the Project Tree panel) when you click the Generate Code button, you must open the Property panel, and under [Code Generator Setting] tab >> [Generate File Mode] >> [Register files], specify "Register the generated files to the project".

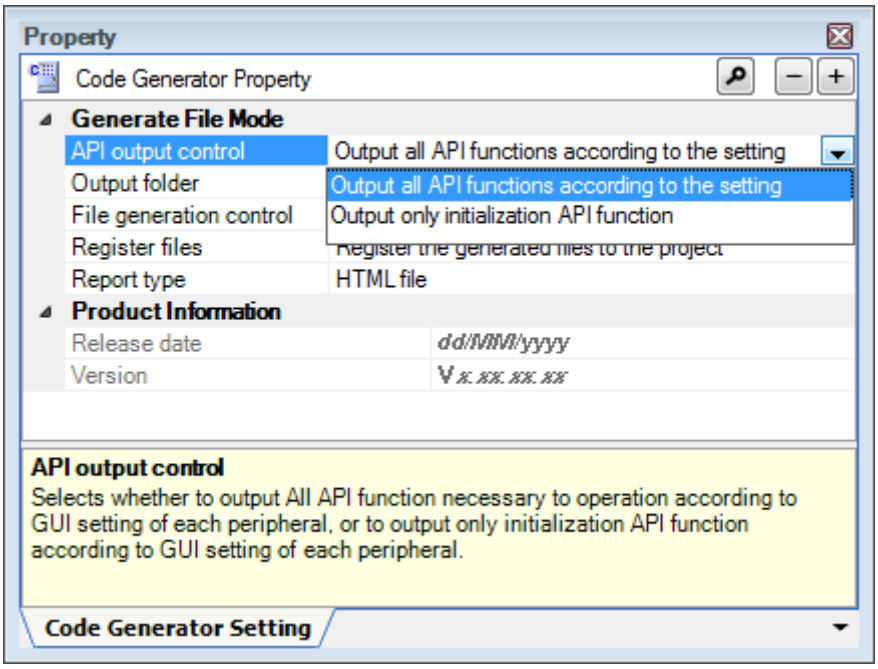
Figure 3-6. Configure Whether to Register



3.5.1 Set whether or not to generate source code

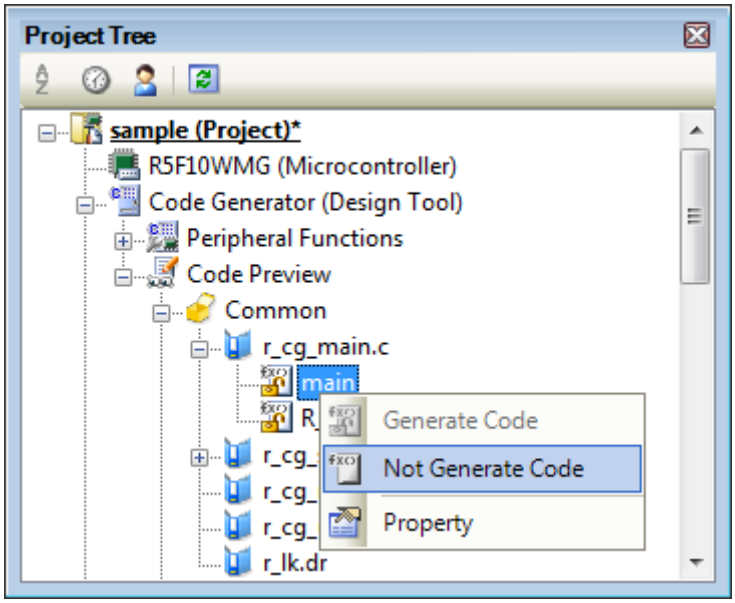
You can set the type of output API functions (all API functions or only initialization API functions) by selecting [Output all API functions according to the setting/Output only initialization API function] from [Code Generator Setting] tab >> [Generate File Mode] >> [API output control] in the Property panel.

Figure 3-7. Setting That Determines Type of API Functions



In the Code Generator, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node >> API function node in the Project Tree panel. "Setting That Determines Whether or Not to Generate Source Code" can be set in units of API functions by selecting "Generate Code/Not Generate Code" from the context menu, which is displayed by right clicking the mouse.

Figure 3-8. Setting That Determines Whether or Not to Generate Source Code



Remark Setting That Determines Whether or Not to Generate Source Code" can be confirmed by the types of icons that are displayed immediately to the left of the API function nodes.

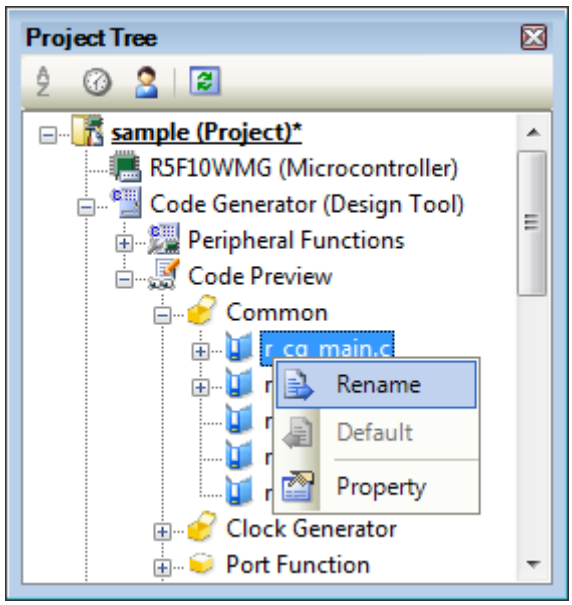
Table 3-4. Setting That Determines Whether or Not to Generate Source Code

Type of Icon	Outline
	Source code for the currently selected API function is generated. If this icon is displayed next to the API function, the corresponding source code must be generated (it is impossible to change the icon to ).
	Source code for the currently selected API function is generated.
	Source code for the currently selected API function is not generated.

3.5.2 Change file name

In the Code Generator, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node in the Project Tree panel. The name of the file can be changed by selecting "Rename" from the context menu, which is displayed by right clicking the mouse.

Figure 3-9. Change File Name

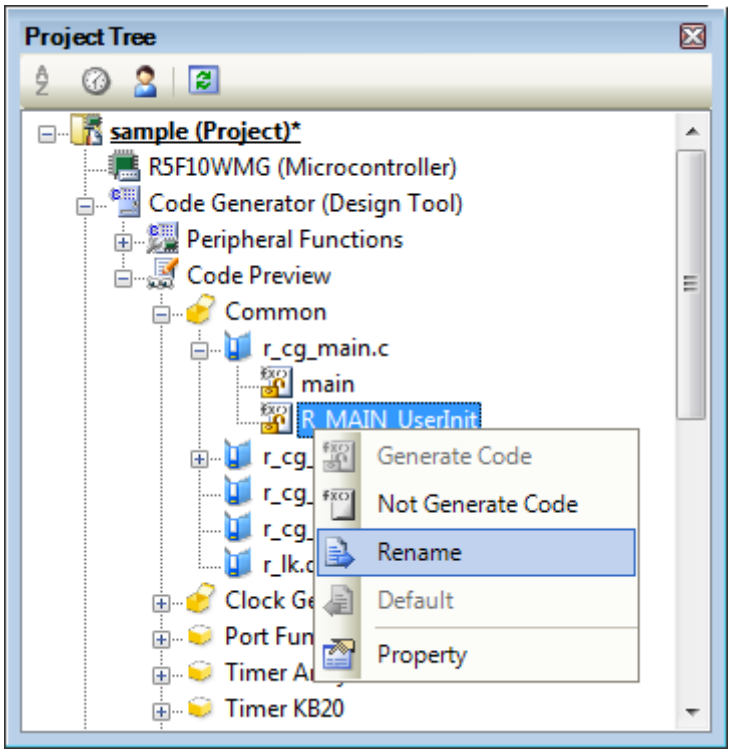


Remark To restore the default file name defined by the Code Generator, select [Default] from the context menu.

3.5.3 Change API function name

In the Code Generator, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node >> API function node in the Project Tree panel. The name of the API function can be changed by selecting "Rename" from the context menu, which is displayed by right clicking the mouse.

Figure 3-10. Change API Function Name



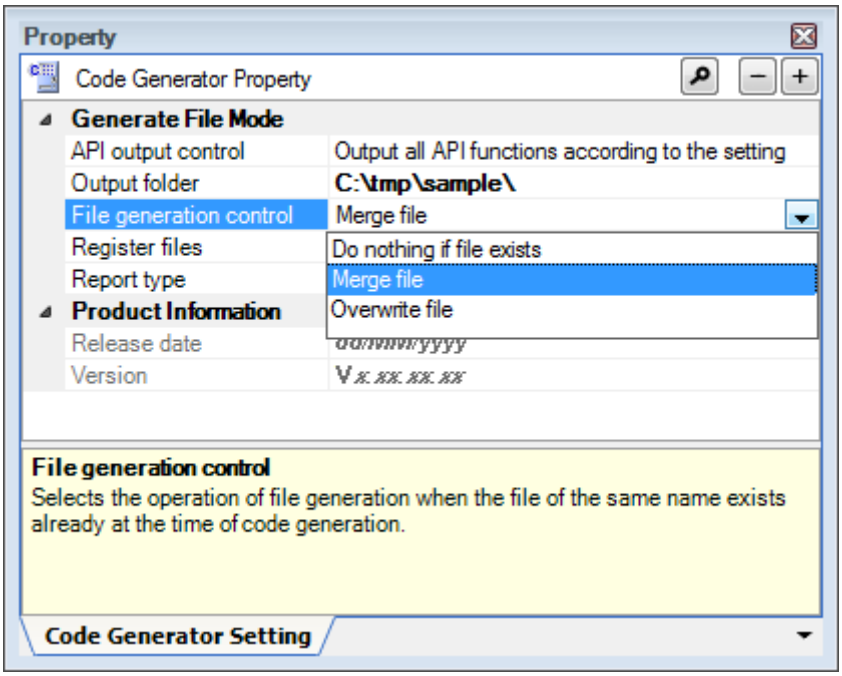
Remarks 1. To restore the default name of the API function defined by the Code Generator, select [Default] from the context menu.

2. Some API functions (main, etc.) can not be changed the API function name.

3.5.4 Change output mode

The Code Generator is used to change the output mode (Do nothing if file exists, Merge file, Overwrite file) for the source code by selecting [Code Generator Setting] tab >> [Generate File Mode] >> [File generation control] in the Property panel.

Figure 3-11. Change Output Mode



The output mode is selected from the following three types.

Table 3-5. Output Mode of Source Code

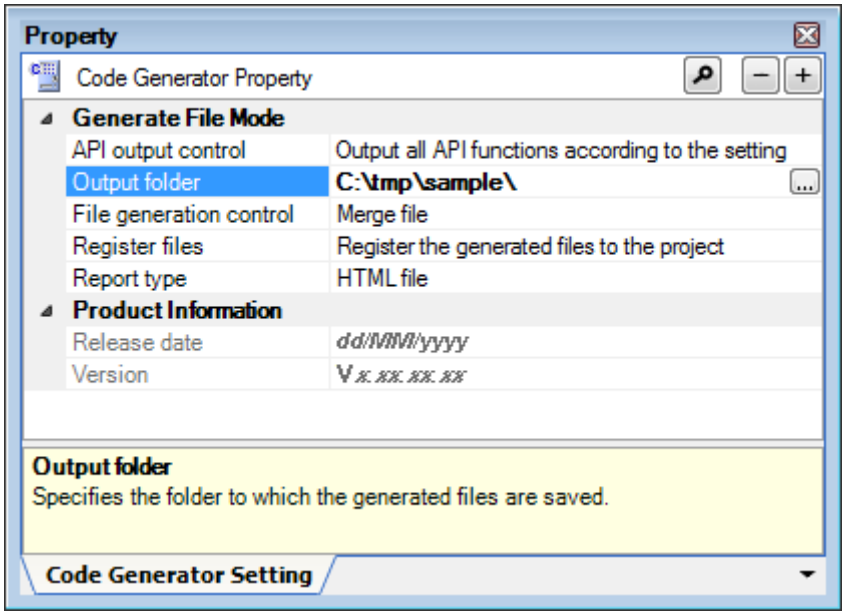
Output Mode	Outline
Do nothing if file exists	If a file with the same name exists, a new file will not be output.
Merge file	If a file with the same name exists, a new file is merged with the existing file. Only the section between "/* Start user code ... . Do not edit comment generated here */" and "/* End user code. Do not edit comment generated here */" will be merged.
Overwrite file	If a file with the same name exists, the existing file is overwritten by a new file.

Remark Note that if the [Merge file] option is selected, the number of left braces ("{") and right braces ("}") must match in the parts to be merged. When the numbers do not match, processing for correct merging is not possible.

3.5.5 Change output destination folder

The Code Generator is used to change the output destination folder for the source code by selecting [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.

Figure 3-12. Change Output Destination Folder



3.6 Output Report Files

Output report files (a file containing information configured using Code Generator and a file containing information regarding the source code) by first activating the Peripheral Functions panel or Code Preview panel, then selecting [File] menu >> [Save Code Generator Report].

The destination folder for the report file is specified by clicking [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.

Remarks 1. You can only use "Function" or "Macro" as a name of the report file.
See "3.6.1 Change output format" for details on the output format.

Table 3-6. Output Report Files

File Name	Outline
Function.*xxx*	A file that contains the information regarding the source code
Macro.*xxx*	A file that contains the information configured using Code Generator

2. The output mode of the report file is defined in "Overwrite file".

Figure 3-13. Output Example of Report File "Function" (HTML File)

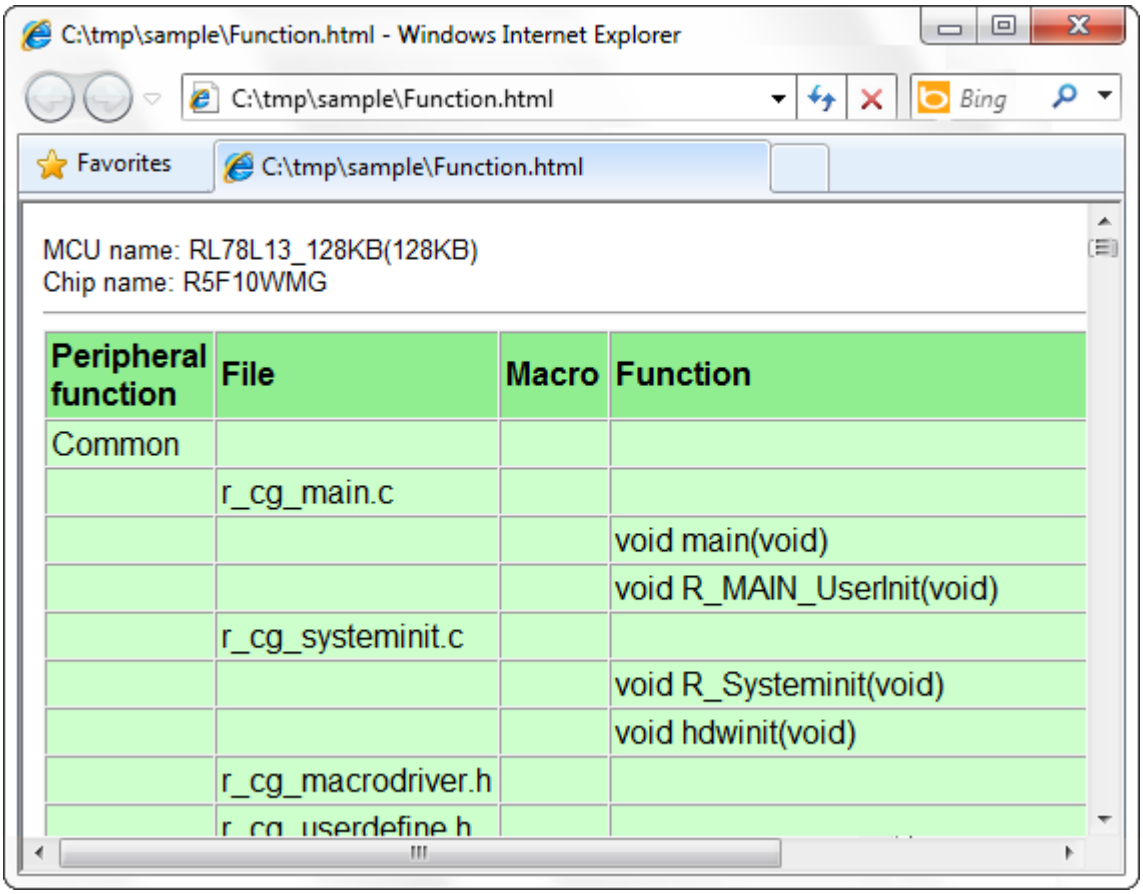
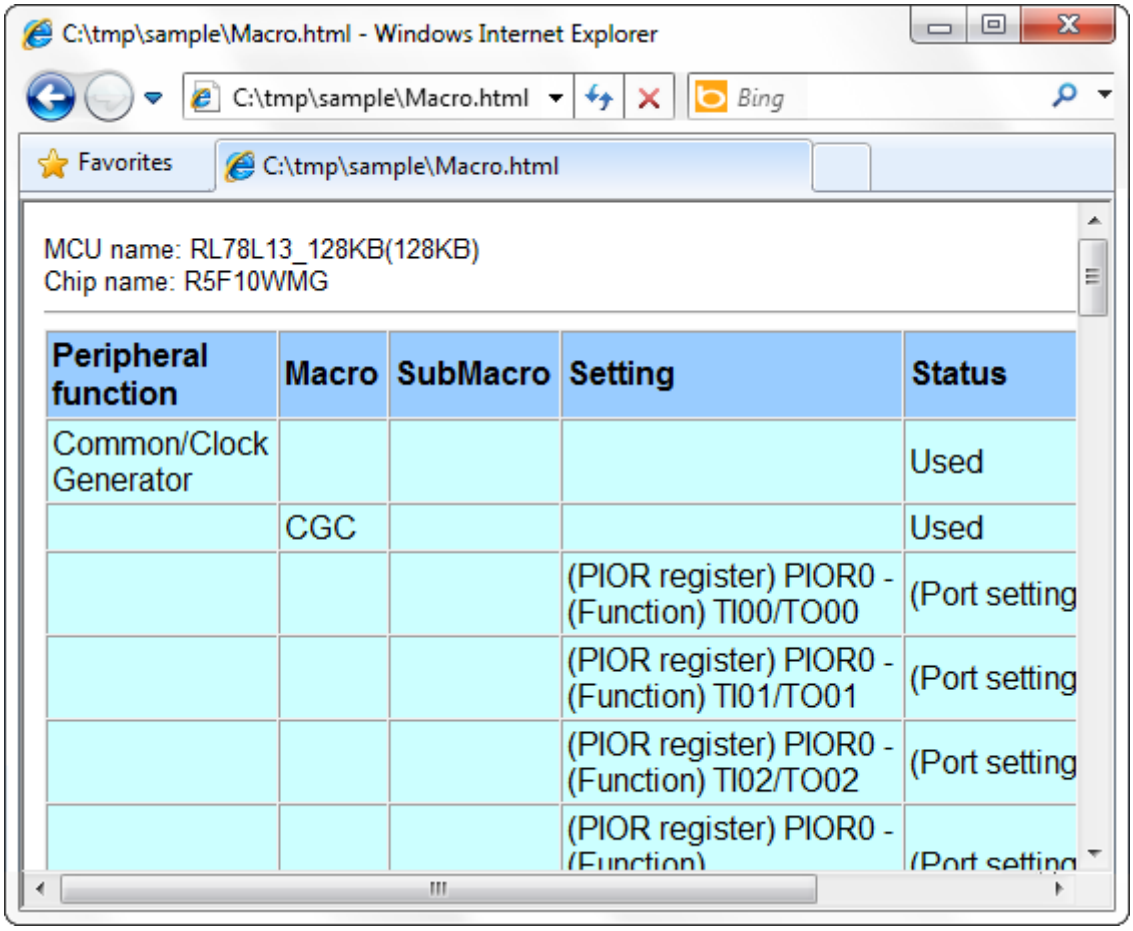


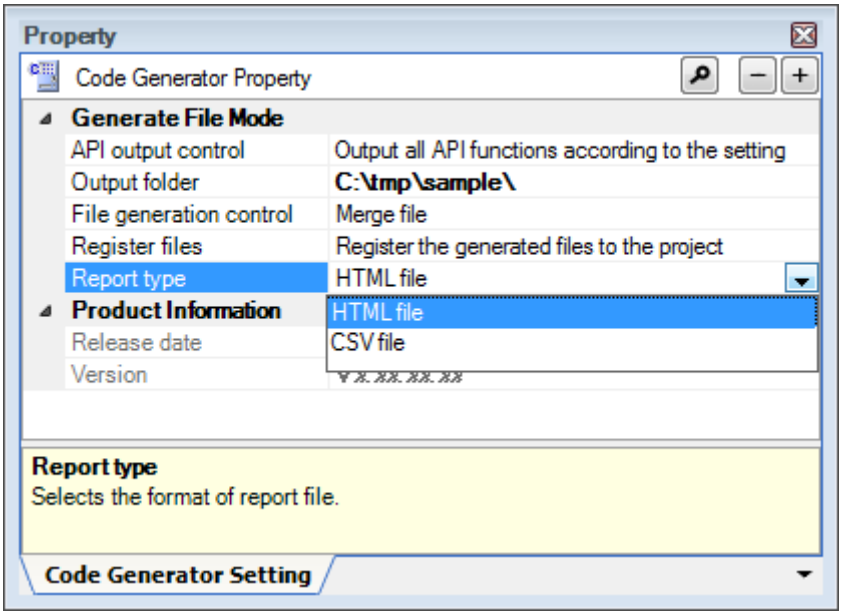
Figure 3-14. Output Example of Report File "Macro" (HTML File)



3.6.1 Change output format

The Code Generator is used to change the output format (HTML file or CSV file) of the report file by selecting [Code Generator Setting] tab >> [Generate File Mode] >> [Report type] in the Property panel.

Figure 3-15. Change Output Format



Remark The output format of the report file is selected from the two types shown below.

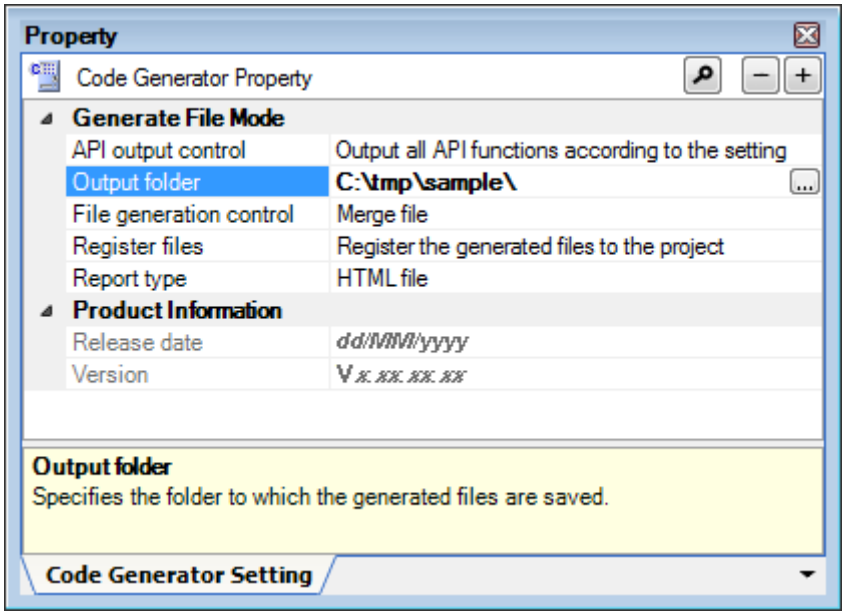
Table 3-7. Output Format of Report File

Report Type	Outline
HTML file	Outputs in the HTML format.
CSV file	Outputs in the CSV format.

3.6.2 Change output destination folder

The Code Generator is used to change the output destination folder for the report file by selecting [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.

Figure 3-16. Change Output Destination Folder



APPENDIX A WINDOW REFERENCE

This appendix explains in detail the functions of the windows, panels and dialog boxes of the design tool.

A.1 Description

The design tool has the following windows, panels and dialog boxes.

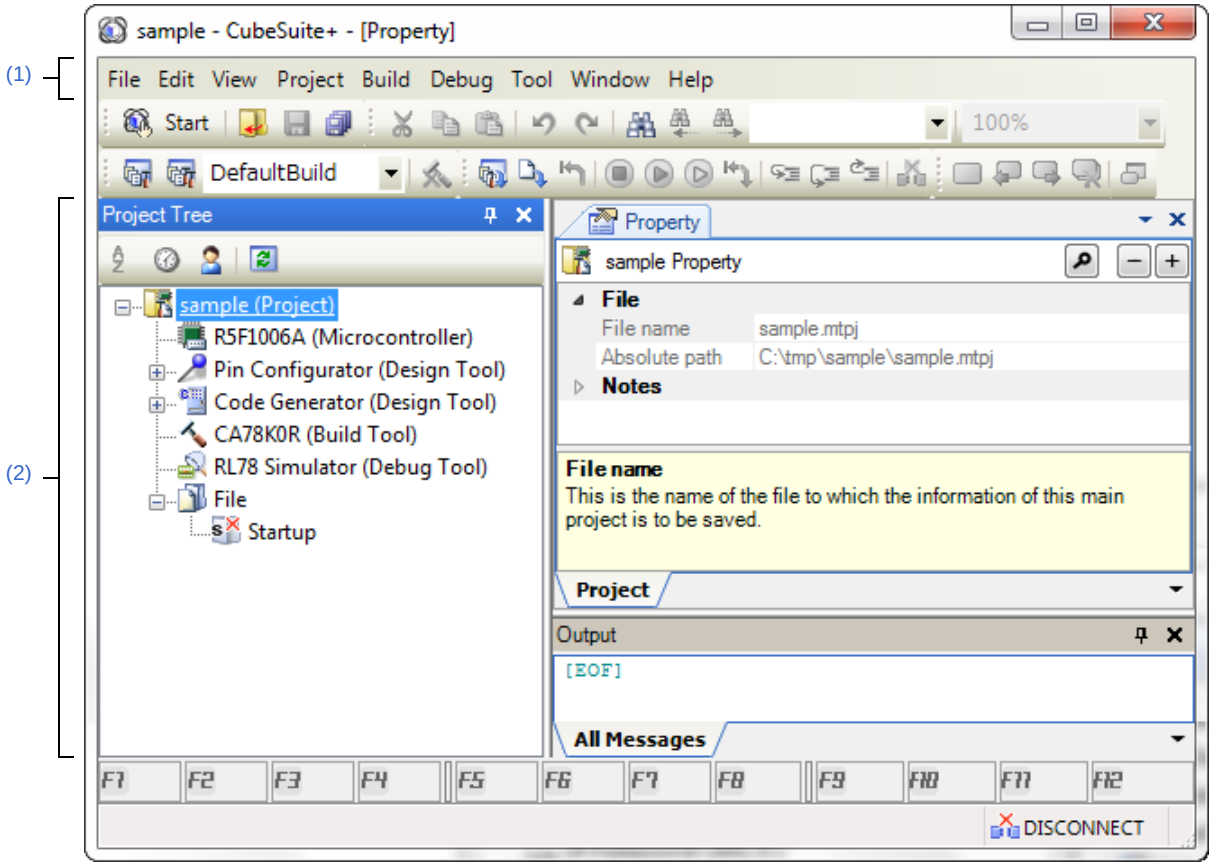
Table A-1. Window/Panel/Dialog Box List

Window/Panel/Dialog Box Name	Function
Main window	This is the first window to open when CubeSuite+ is launched. This window is used to operate various components (design tool, build tool, etc.) provided by CubeSuite+.
Project Tree panel	This panel displays the components of the project (microcontroller, design tool, build tool, etc.) in a tree structure.
Property panel	This panel allows you to view the information on and change the setting for the node selected in the Project Tree panel.
Device Pin List panel	This panel allows you to enter information on each pin of the microcontroller.
Device Top View panel	This panel displays the information entered in the Device Pin List panel.
Peripheral Functions panel	This panel allows you to configure the information necessary to control the peripheral functions (clock generator, port functions, etc.) provided.
Code Preview panel	This panel allows you to confirm the source code in accord with the settings of the Peripheral Functions panel.
Output panel	This panel displays operation logs for various components (design tool, build tool, etc.) provided by CubeSuite+.
Column Chooser dialog box	This dialog box allows you to choose whether or not to display the item listed in this dialog box in the device pin list, and add columns to or delete columns from the device pin list.
New Column dialog box	This dialog box allows you to add your own column to the device pin list.
Save As dialog box	This dialog box allows you to name and save a file.

Main window

This is the first window to open when CubeSuite+ is launched. This window is used to operate various components (design tool, build tool, etc.) provided by CubeSuite+.

Figure A-1. Main Window



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- From the [start] menu, select [All Programs] >> [Renesas Electronics CubeSuite+] >>[CubeSuite+].

[Description of each area]

(1) Menu bar

This area consists of the following menu items.

(a) [File] menu

Save Pin List	Device Pin List panel-dedicated item Saves a report file (a file containing information configured using Pin Configurator: device pin list) overwriting the existing file.

Save Pin List As...	Device Pin List panel-dedicated item Opens the Save As dialog box for naming and saving a report file (a file containing information configured using Pin Configurator: device pin list).
Save Top View	Device Top View panel-dedicated item Saves a report file (a file containing information configured using Pin Configurator: device top view) overwriting the existing file.
Save Top View As...	Device Top View panel-dedicated item Opens the Save As dialog box for naming and saving a report file (a file containing information configured using Pin Configurator: device top view).
Save Code Generator Report	Peripheral Functions panel/Code Preview panel-dedicated item Outputs report files (a file containing information configured using Code Generator and a file containing information regarding the source code). - The output format for the report file (either HTML file or CSV file) is selected by clicking [Code Generator Setting] tab >> [Generate File Mode] >> [Report type] in the Property panel. - The destination folder for the report file is specified by clicking [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.
Save Output-*Tab Name*	Output panel-dedicated item Saves the message corresponding to the specified tab overwriting the existing file.
Save Output-*Tab Name* As...	Output panel-dedicated item Opens the Save As dialog box for naming and saving the message corresponding to the specified tab.

(b) [Edit] menu

Undo	Property panel-dedicated item Cancels the effect of an edit operation to restore the previous state.
Cut	Property panel-dedicated item Sends the character string or lines selected with range selection to the clipboard and deletes them.
Copy	Property panel/Output panel-dedicated item Sends the character string or lines selected with range selection to the clipboard.
Paste	Property panel-dedicated item Inserts the contents of the clipboard at the caret position.
Delete	Property panel-dedicated item Deletes the character string or the lines selected with the range selection.
Select All	Property panel/Output panel-dedicated item Selects all the strings displayed in the item being edited or all the strings displayed in the Message area.
Search...	Device Pin List panel/Code Preview panel/Output panel-dedicated item Opens the Search and Replace dialog box for searching strings with the [Quick Search] tab selected.
Replace...	Output panel-dedicated item Opens the Search and Replace dialog box for replacing strings with the [Whole Replace] tab selected.

(c) [View] menu

Project Tree	Project Tree panel-dedicated item Opens the Project Tree panel.	
Property	Property panel-dedicated item Opens the Property panel.	
Output	Output panel-dedicated item Opens the Output panel.	
Pin Configurator	The cascading menu shown below is displayed.	
	Device Pin List	Device Pin List panel-dedicated item Opens the Device Pin List panel.
	Device Top View	Device Top View panel-dedicated item Opens the Device Top View panel.
Code Generator 2	The cascading menu shown below is displayed.	
	Peripheral Functions	Peripheral Functions panel-dedicated item Opens the Peripheral Functions panel.
	Code Preview	Code Preview panel-dedicated item Opens the Code Preview panel.

(d) [Help] menu

Open Help for Project Tree Panel	Project Tree panel-dedicated item Displays the help of Project Tree panel.
Open Help for Property Panel	Property panel-dedicated item Displays the help of Property panel.
Open Help for Device Pin List Panel	Device Pin List panel-dedicated item Displays the help of Device Pin List panel.
Open Help for Device Top View Panel	Device Top View panel-dedicated item Displays the help of Device Top View panel.
Open Help for [Code Generator]panel	Peripheral Functions panel-dedicated item Displays the help of Peripheral Functions panel.
Open Help for [Code Generator Preview]panel	Code Preview panel-dedicated item Displays the help of Code Preview panel.
Open Help for Output Panel	Output panel-dedicated item Displays the help of Output panel.

(2) Panel display area

This area consists of multiple panels, each dedicated to a different purpose.

See the following sections for details on this area.

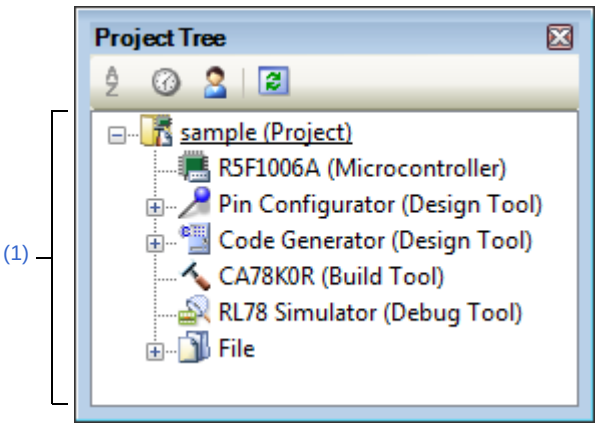
- Project Tree panel
- Property panel
- Device Pin List panel
- Device Top View panel
- Peripheral Functions panel
- Code Preview panel

- Output panel

Project Tree panel

This panel displays components of the project (microcontroller, design tool, build tool, etc.) in a tree structure.

Figure A-2. Project Tree Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [Context menu]

[How to open]

- From the [View] menu, select [Project Tree].

[Description of each area]

(1) Project tree area

This area displays components of the project (microcontroller, design tool, build tool, etc.) in a tree structure.

(a) Pin Configurator (Design Tool)

This node consists of the following pin nodes.

Device Pin List	Opens the Device Pin List panel for entering information on the pins of the microcontroller.
Device Top View	Opens the Device Top View panel that displays the information entered in the Device Pin List panel.

(b) Code Generator (Design Tool)

The sub-nodes of this node are [Peripheral Functions] and [Code Preview].

<1> [Peripheral Functions]

The sub-node of this node is the peripheral function node for the peripheral functions (clock generator, port functions, etc.) supported by the target device.

Peripheral function node	Double-click on a peripheral function node or press the [Enter] key after selecting a peripheral function node to open the Peripheral Functions panel, which is used to make settings for control of the corresponding peripheral function.

Icons that are displayed immediately to the left of each peripheral function node have the meanings listed below.

	Operation in the corresponding Peripheral Functions panel has been carried out.
	Operation in the corresponding Peripheral Functions panel has not been carried out.
 , 	The problem occurs on the settings became the manipulation to the other peripheral function node influences.

<2> [Code Preview]

The sub-node of this node is the peripheral function node for the peripheral functions (clock generator, port functions, etc.) supported by the target device.

Peripheral function node	Double-click on a source code node/API function node in the level of the hierarchy below this node or select a source code node/API function node and press the [Enter] key to open the Code Preview panel, which is used to confirm that the source code corresponds to the settings in the Peripheral Functions panel.

Icons that are displayed immediately to the left of each peripheral function node have the meanings listed below.

	Operation in the corresponding Peripheral Functions panel has been carried out.
	Operation in the corresponding Peripheral Functions panel has not been carried out.

[Context menu]

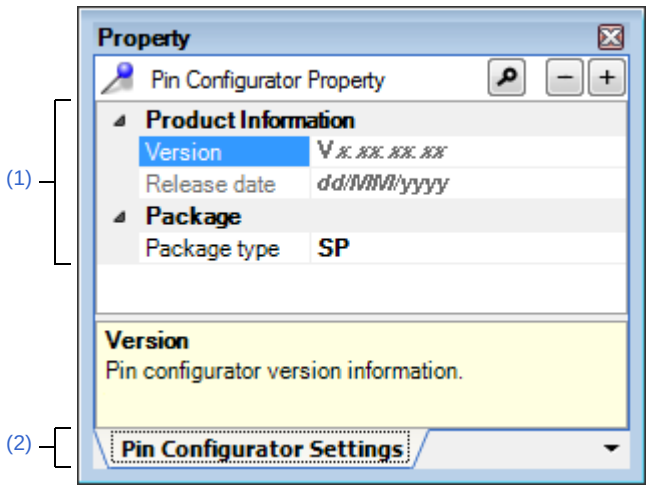
The following context menu items are displayed by right clicking the mouse.

Return to Reset Value	The default settings of the selected node are restored.
Property	Opens the Property panel corresponding to the selected node.

Property panel

This panel allows you to view the information on and change the setting for the node selected in the Project Tree panel.

Figure A-3. Property Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [Context menu]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)], and then select [Property] from the context menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then select [Property] from the context menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View], and then select [Property] from the context menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)], and then select [Property] from the context menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] (>> Peripheral function node), and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] (>> Peripheral function node), and then select [Property] from the context menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] (>> Peripheral function node >> Source code node >> API function node), and then select [Property] from the [View] menu.

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] (>> Peripheral function node >> Source code node >> API function node), and then select [Property] from the context menu.

Remarks 1. If this panel is already open, selecting a different [Pin Configurator (Design Tool)] in the Project Tree panel changes the content displayed accordingly.

2. If this panel is already open, selecting a different [Device Pin List] in the Project Tree panel changes the content displayed accordingly.

3. If this panel is already open, selecting a different [Device Top View] in the Project Tree panel changes the content displayed accordingly.

4. If this panel is already open, selecting a different [Code Generator (Design Tool)] in the Project Tree panel changes the content displayed accordingly.

5. If this panel is already open, selecting [Peripheral Functions] (>> Peripheral function node) in the Project Tree panel changes the content displayed to that corresponding to the selected node.

6. If this panel is already open, selecting [Code Preview] (>> Peripheral function node >> source code node >> API function node) in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) Detail information display/change area

This area allows you to view the information on and change the setting for the node selected in the Project Tree panel.

The content displayed in this area differs depending on the node selected in the Project Tree panel.

The following table displays the meaning of ⊞ and ⊟ displayed to the left of each category.

⊞	Indicates that the items within the category are displayed as a "collapsed view".
⊟	Indicates that the items within the category are displayed as an "expanded view".

Remark To switch between ⊞ and ⊟ , click this mark or double-click the category name.

(2) Tab selection area

In this panel, following tabs are contained (see the section explaining each tab for details on the display/setting on the tab).

- [Pin Configurator Settings] tab
- [Device Pin List Information] tab
- [Device Top View Settings] tab
- [Code Generator Setting] tab
- [Peripheral Function Information] tab (Product Information)
- [Peripheral Function Information] tab (Peripheral Function Information)
- [Code Preview Information] tab (Product Information)
- [Code Preview Information] tab (Peripheral Function Information)
- [Code Preview Setting] tab (File Information)
- [Code Preview Setting] tab (Function Information)

[Context menu]

The following context menu items are displayed by right clicking the mouse.

(1) While the item is being edited

Undo	Cancels the effect of an edit operation to restore the previous state.
Cut	Sends the character string or lines selected with range selection to the clipboard and deletes them.
Copy	Sends the character string or lines selected with range selection to the clipboard.
Paste	Inserts the contents of the clipboard at the caret position.
Delete	Deletes the character string or the lines selected with the range selection.
Select All	Selects all strings displayed in the item being edited.

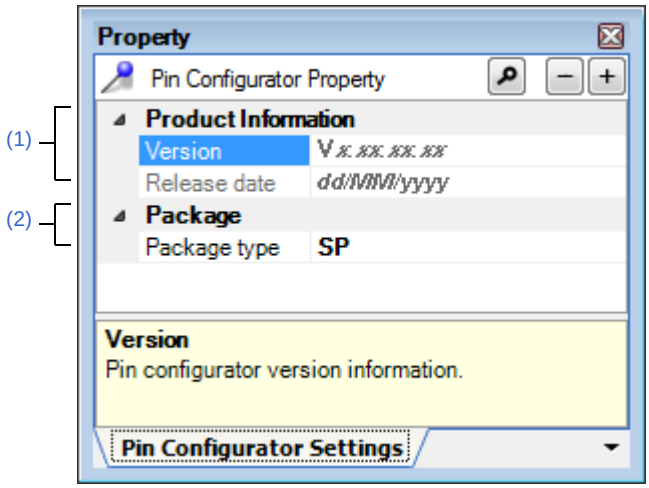
(2) While the item is not being edited

Property Reset to Default	The selected items are returned to their default settings.
Property Reset All to Default	All items displayed in this tab are returned to their default settings.

[Pin Configurator Settings] tab

This tab displays information (Product Information and Package) on the [Pin Configurator (Design Tool)] selected in the Project Tree panel.

Figure A-4. [Pin Configurator Settings] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)], and then select [Property] from the context menu.

Remark If this panel is already open, selecting a different [Pin Configurator (Design Tool)] in the Project Tree panel changes the content displayed accordingly.

[Description of each area]

(1) [Product Information] category

This area displays product information (Version and Release date) on Pin Configurator.

Version	Displays the version of Pin Configurator (Pin Configurator Plug-in).
Release date	Displays the release date of Pin Configurator (Pin Configurator Plug-in).

(2) [Package] category

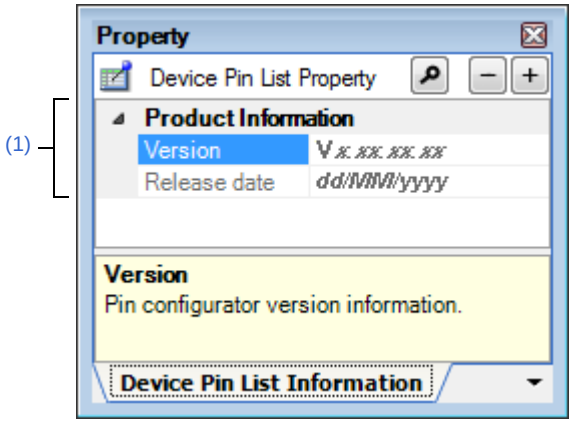
Change the shape (Package type) and settings of the microcontroller to display as the device top view in the Device Top View panel.

Package type	Selects the shape of the microcontroller displayed in the device top view.

[Device Pin List Information] tab

This tab displays information (Product Information) on the [Device Pin List] selected in the Project Tree panel.

Figure A-5. [Device Pin List Information] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then select [Property] from the context menu.

Remark If this panel is already open, selecting a different [Device Pin List] in the Project Tree panel changes the content displayed accordingly.

[Description of each area]

(1) [Product Information] category

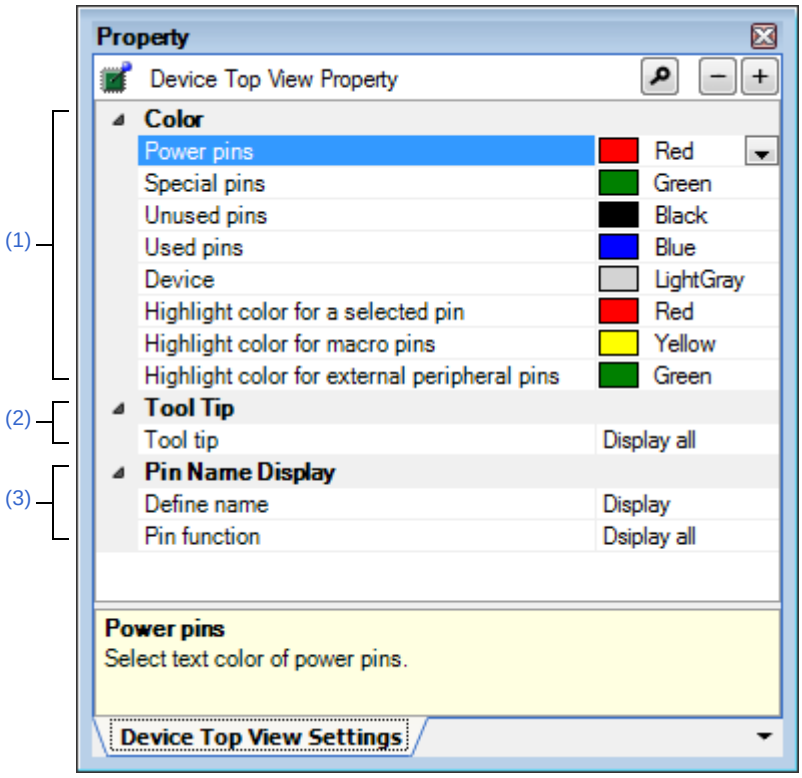
This area displays product information (Version and Release date) on Pin Configurator.

Version	Displays the version of Pin Configurator (Pin Configurator Plug-in).
Release date	Displays the release date of Pin Configurator (Pin Configurator Plug-in).

[Device Top View Settings] tab

This tab allows you to view the information (Color, Tool Tip and Pin Name Display) on and change the setting for the [Device Top View] selected in the Project Tree panel.

Figure A-6. [Device Top View Settings] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View], and then select [Property] from the context menu.

Remark If this panel is already open, selecting a different [Device Top View] in the Project Tree panel changes the content displayed accordingly.

[Description of each area]

(1) [Color] category

Select the display colors to differentiate the pin groups (Power pins, Special pins, etc.) in the device top view.

Power pins	Selects the display color for power pins (pins whose use is limited to power).

Special pins	Selects the display color for special pins (pins with specified uses).
Unused pins	Selects the display color for unused pins (dual-use pins with no use set in the Device Pin List panel).
Used pins	Selects the display color for used pins (dual-use pins with a use set in the Device Pin List panel).
Device	Selects the display color of the microcontroller.
Highlight color for a selected pin	Selects the background color of a pin selected in the Device Pin List panel, on the [Pin Number] tab.
Highlight color for macro pins	Selects the background color of pins selected in the Device Pin List panel, on the [Macro] tab.
Highlight color for external peripheral pins	Selects the background color of pins selected in the Device Pin List panel, on the [External Peripheral] tab.

(2) [Tool Tip] category

Select whether to display a tooltip with information about a pin when the mouse cursor is moved over the pin in the device top view.

Tool tip	Selects whether to display a tooltip with information about a pin when the mouse cursor is moved over the pin in the device top view panel.	
	Display all	Displays the "Description", "Recommend Connection for Unused", and "Attention" strings for the device pin list.
	Description / recommended connection for unused pin only	Displays the "Description", and "Recommend Connection for Unused" strings for the device pin list.
	Attention only	Displays the "Attention" string for the device pin list.
	Not display	Hides tooltips when the mouse cursor hovers over a pin.

(3) [Pin Name Display] category

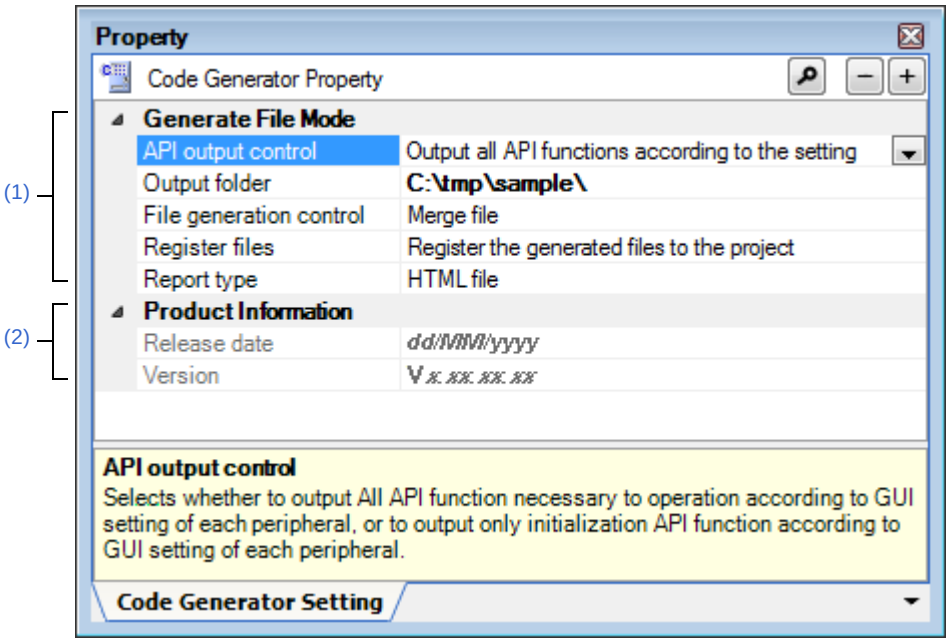
Select whether to display additional information about the pin in the device top view.

Define name	Selects whether to display the "Define Name" string of the device pin list appended to the pin in the device top view.	
	Display	Displays the "Define Name" string of the device pin list in appended format.
	Not display	Hides the "Define Name" string of the device pin list.
Pin function	Selects whether to also display unselected functions in the device top view when a function has been selected from the device pin list's "Function" feature.	
	Display all	Displays functions selected via the device pin list's "Function" feature in parentheses.
	Selected function only	Only display functions selected via the device pin list's "Function" feature in the device top view.

[Code Generator Setting] tab

This tab allows you to view the information (Generate File Mode and Product Information) on and change the setting for the [Code Generator (Design Tool)] selected in the Project Tree panel.

Figure A-7. [Code Generator Setting] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)], and then select [Property] from the context menu.

Remark If this panel is already open, selecting a different [Code Generator (Design Tool)] in the Project Tree panel changes the content displayed accordingly.

[Description of each area]

(1) [Generate File Mode] category

This area allows you to view the information (API output control, Output folder, File generation control, Register files and Report type) on and change the setting for the [Code Generator (Design Tool)] selected in the Project Tree panel.

API output control	Select the type of API functions to be output.	
	Output all API functions according to the setting	All API functions for the peripheral functions (clock generation circuit, voltage detection circuit, etc.) that is set for use in the Peripheral Functions panel are output.
	Output only initialization API function	Of the API functions for the peripheral functions (clock generation circuit, voltage detection circuit, etc.) that are set for use in the Peripheral Functions panel, only those relating to initialization are output.
Output folder	Inputs the output destination folder.	
File generation control	Click on this option to select the reaction to cases where a file having the same file name exists when the Generate Code button of the Peripheral Functions panel is clicked.	
	Do nothing if file exists	If a file with the same name exists, a new file will not be output.
	Merge file	If a file with the same name exists, a new file is merged with the existing file. Only the section between "/* Start user code ... . Do not edit comment generated here */" and "/* End user code. Do not edit comment generated here */" will be merged.
	Overwrite file	If a file with the same name exists, the existing file is overwritten by a new file.
Register files	Click on this option to select whether or not to register the output file in the project when the Generate Code button of the Peripheral Functions panel is clicked.	
	Register the generated files to the project	Registers the file.
	Not register the generated files to the project	Does not register the file.
Report type	Selects the output format for the report files (two files: Function and Macro) that are output when [Save Code Generator Report] is selected from the [File] menu.	
	HTML file	Outputs the files in the HTML format.
	CSV file	Outputs the files in the CSV format.

Remark Note that if the [Merge file] is selected in [File generate control], the number of left braces ("{") and right braces ("}") must match in the parts to be merged. When the numbers do not match, processing for correct merging is not possible.

(2) [Product Information] category

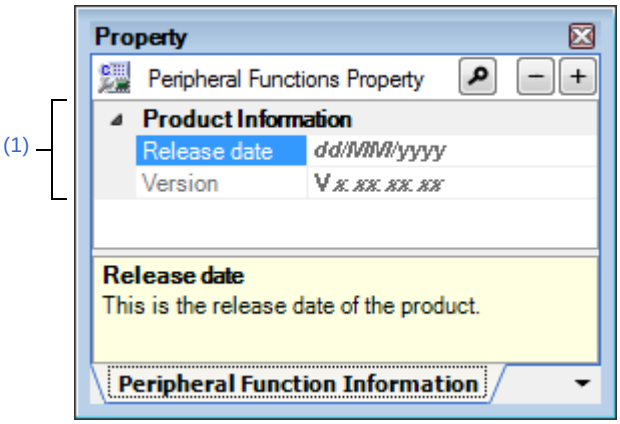
This area allows you to view the information (Release Date and Version) for the [Code Generator (Design Tool)] selected in the Project Tree panel.

Release Date	Displays the release date of the Code Generator (Design Tool).
Version	Displays the version number of the Code Generator (Design Tool).

[Peripheral Function Information] tab (Product Information)

This tab allows you to view the information (Product Information) for the [Peripheral Functions] selected in the Project Tree panel.

Figure A-8. [Peripheral Function Information] Tab (Product Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions], and then select [Property] from the context menu.

Remark If this panel is already open, selecting [Peripheral Functions] in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [Product Information] category

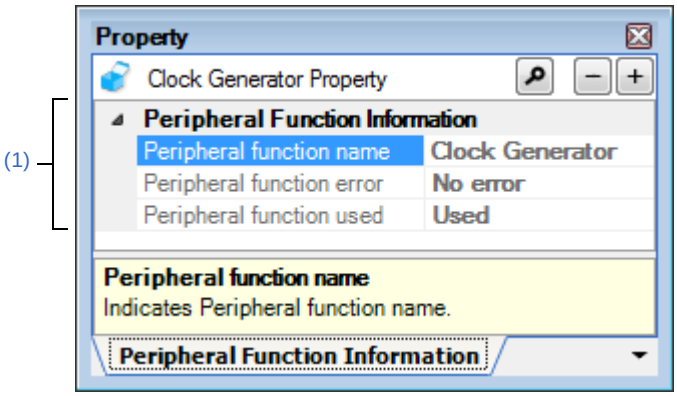
This area allows you to view the information (Release date and Version) for the [Peripheral Functions] selected in the Project Tree panel.

Displays the release date of the Code Generator (Design Tool).	Release Date
Displays the version number of the Code Generator (Design Tool).	Version

[Peripheral Function Information] tab (Peripheral Function Information)

This tab allows you to view the information (Peripheral Function Information) for the peripheral function node selected in the Project Tree panel.

Figure A-9. [Peripheral Function Information] Tab (Peripheral Function Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] >> Peripheral function node, and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] >> Peripheral function node, and then select [Property] from the context menu.

Remark If this panel is already open, selecting peripheral function node in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [Peripheral Function Information] category

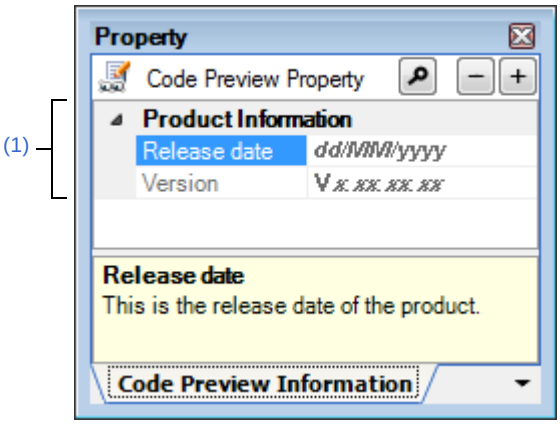
This area allows you to view the information (Peripheral function name, Peripheral function error and Peripheral function used) for the peripheral function node selected in the Project Tree panel.

Peripheral function name	Displays the name of the peripheral function.	
Peripheral function error	Displays whether or not the settings in the Peripheral Functions panel are correct.	
	No error	Illegal settings have not been detected.
	Input error	Illegal settings have been detected.
Peripheral function used	Indicates whether or not to use the peripheral function. Note that whether or not a function is to be used depends on the settings in the Peripheral Functions panel corresponding to the selected node.	
	Used	The peripheral function is to be used.
	No	The peripheral function is not to be used.

[Code Preview Information] tab (Product Information)

This tab allows you to view the information (Product Information) for the [Code Preview] selected in the Project Tree panel.

Figure A-10. [Code Preview Information] Tab (Product Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview], and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview], and then select [Property] from the context menu.

Remark If this panel is already open, selecting [Peripheral Functions] in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [Product Information] category

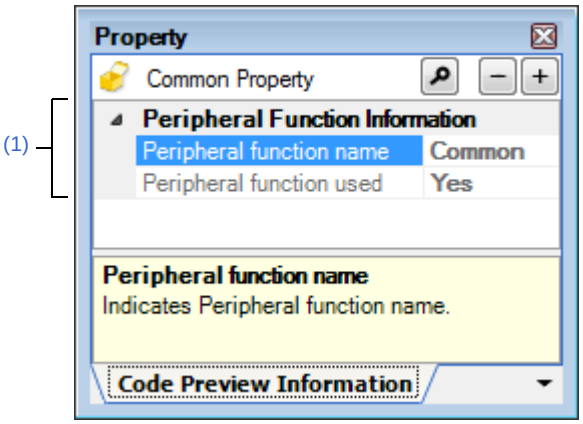
This area allows you to view the information (Release Date and Version) for the [Code Preview] selected in the Project Tree panel.

Release Date	Displays the release date of the Code Generator (Design Tool).
Version	Displays the version number of the Code Generator (Design Tool).

[Code Preview Information] tab (Peripheral Function Information)

This tab allows you to view the information (Peripheral Function Information) for the peripheral function node selected in the Project Tree panel.

Figure A-11. [Code Preview Information] Tab (Peripheral Function Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node, and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node, and then select [Property] from the context menu.

Remark If this panel is already open, selecting peripheral function node in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [Peripheral Function Information] category

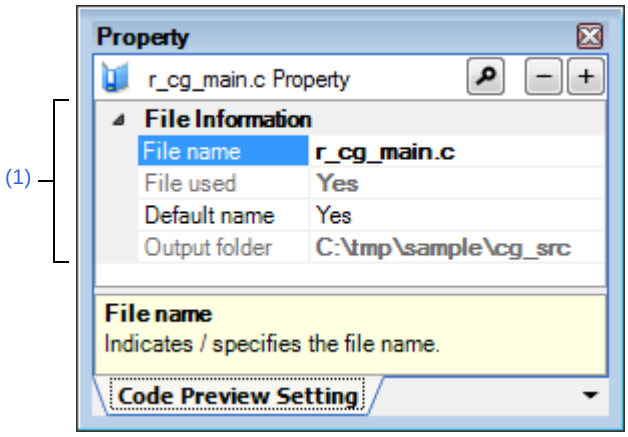
This area allows you to view the information (Peripheral function name and Peripheral function used) for the peripheral function node selected in the Project Tree panel.

Peripheral function name	Displays the name of the peripheral function.	
Peripheral function used	Indicates whether or not to use the peripheral function. Note that whether or not a function is to be used depends on the settings in the Peripheral Functions panel corresponding to the selected node.	
	Yes	The peripheral function is to be used.
	No	The peripheral function is not to be used.

[Code Preview Setting] tab (File Information)

This tab allows you to view the information (File Information) on and change the setting for the source code node selected in the Project Tree panel.

Figure A-12. [Code Preview Setting] Tab (File Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node, and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node, and then select [Property] from the context menu.

Remark If this panel is already open, selecting the source code node in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [File Information] category

This area allows you to view the information (Fine name, File used, Default name and Output folder) on and change the setting for the source code node selected in the Project Tree panel.

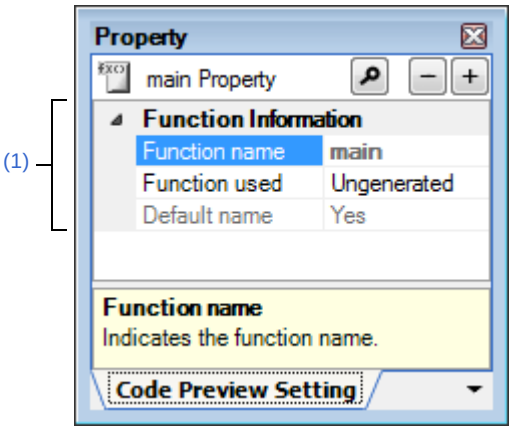
File name	Inputs the name of the file The name of the file can be changed by selecting [Rename] from the context menu after selecting the source code node in the Project Tree panel.	
File used	Indicates whether or not output to a file is to proceed when the Generate Code button in the Peripheral Functions panel is clicked. Note that whether or not this option is used depends on the settings in the Peripheral Functions panel corresponding to the selected node.	
	Yes	A file is output.
	No	A file is not output.

<table>
<tr><td rowspan="3">Default name</td><td colspan="2">Selects whether or not to restore the default name of the file.
Note that the default name of the file can be restored by selecting [Default] from the context menu after selecting the source code node in the Project Tree panel.</td></tr>
<tr><td>Yes</td><td>The default name is restored.</td></tr>
<tr><td>No</td><td>The default name is not restored.</td></tr>
<tr><td>Output folder</td><td colspan="2">Displays the output destination folder.
Note that the output destination folder can be changed by using [Generate File Mode] >> [Output folder] in the [Code Generator Setting] tab.</td></tr>
</table>

[Code Preview Setting] tab (Function Information)

This tab allows you to view the information (Function Information) on and change the setting for the API function node selected in the Project Tree panel.

Figure A-13. [Code Preview Setting] Tab (Function Information)



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node >> API function node, and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node >> API function node, and then select [Property] from the context menu.

Remark If this panel is already open, selecting the API function node in the Project Tree panel changes the content displayed to that corresponding to the selected node.

[Description of each area]

(1) [Function Information] category

This area allows you to view the information (Function name, Function used and Default name) on and change the setting for the API function node selected in the Project Tree panel.

Function name	Inputs the name of the API function. Note that the name of the API function can be changed by selecting [Rename] from the context menu after selecting the API function node in the Project Tree panel.	
Function used	Selects whether or not to output the API function when the Generate Code button in the Peripheral Functions panel is clicked.	
	Generated	The API function is output.
	Ungenerated	The API function is not output.

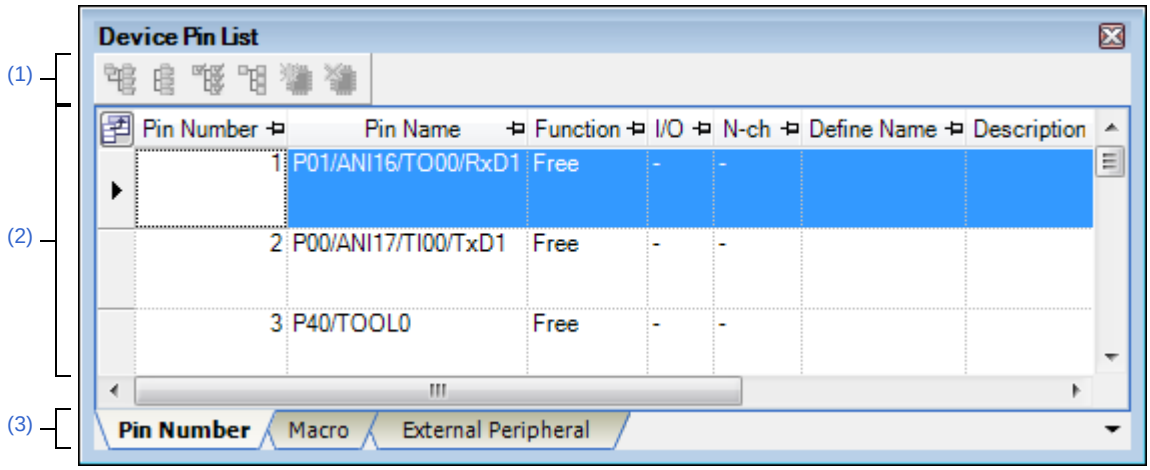
Default name	Selects whether or not to restore the default name of the API function. Note that the default name of the API function can be restored by selecting [Default] from the context menu after selecting the source code node in the Project Tree panel.	
	Yes	The default name is restored.
	No	The default name is not restored.

Device Pin List panel

This panel allows you to enter information on each pin of the microcontroller.

Remark The Device pin list area can be zoomed in and out by 50% in the tool bar, or by operating the mouse wheel while holding down the [Ctrl] key.

Figure A-14. Device Pin List Panel



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List].
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then press the [Enter] key.
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Toolbar

This area consists of the following buttons.

	Displays the information in the Device pin list area in an expanded view.
	Displays the information in the Device pin list area in a folded view only.
	Clicks this button to automatically process the configuration information in the selected function, I/O, N-ch, and other fields after selecting one of the peripheral functions displayed in the first level on the [Macro] tab.
	Clicks this button to initialize the selected function, I/O, N-ch, and other fields after selecting one of the peripheral functions displayed in the first level on the [Macro] tab.

	Clicks this button to create an external peripheral controller from the external peripheral controller information on the [External Peripheral] tab, and display it in the Device Top View panel.
	Clicks this button to delete the information for the external peripheral controller displayed on the [External Peripheral] tab, on the first layer.

Remarks 1. Click the  button to add the information in question as a choice in the "External Parts" column of the [Macro] tab and the [Pin Number] tab.

2. Click the  button to remove the external peripheral component in question from the Device top view area if the Device Top View panel.

(2) Device pin list area

This area displays the "device pin list" for entering information on the pins of the microcontroller.

(3) Tab selection area

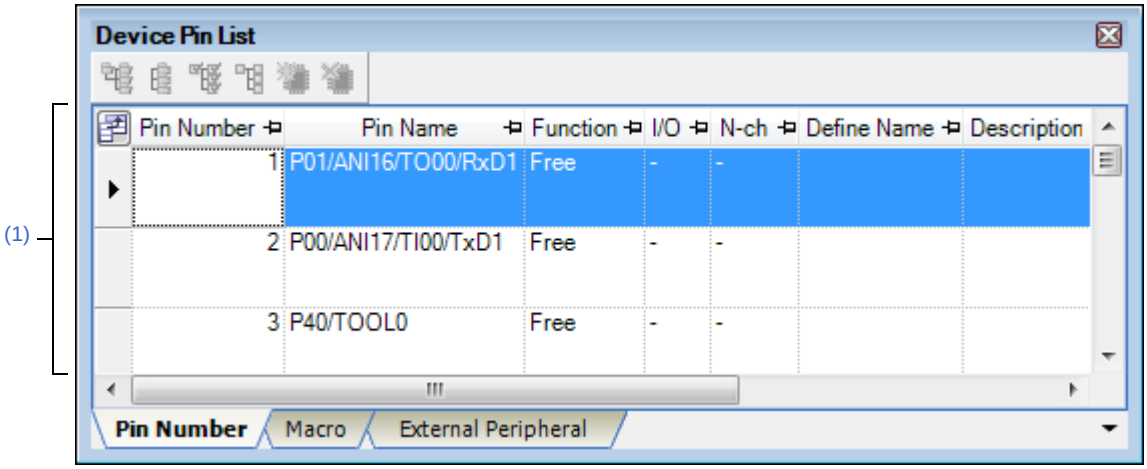
Selecting the tab changes the order in which "information on each pin of the microcontroller" is displayed.
This panel has the following tabs:

- [Pin Number] tab
  This tab displays information on each pin of the microcontroller in the order of pin number.
- [Macro] tab
  This tab displays information on each pin of the microcontroller in the order it was grouped into peripheral functions.
- [External Peripheral] tab
  This tab displays information about the pins connected to external peripherals in order grouped at the external-peripheral component level.

[Pin Number] tab

This tab displays information on each pin of the microcontroller in the order of pin number.

Figure A-15. [Pin Number] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List].
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then press the [Enter] key.
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Device pin list area

This area displays the "device pin list" for entering information on the pins of the microcontroller.
The device pin list in this area is organized in the order of pin number.
The following are the columns comprising the device pin list.

Column Heading	Outline
Pin Number	Displays the pin number of the pin.
Pin Name	This area allows you to select "which function to use" when the pin has more than one functions.
Function	This area allows you to select "which function to use" when the pin has more than one functions.
I/O	This area allows you to select the I/O mode of the pin.
N-ch	This area allows you to select "which output mode to apply" when using the pin in the output mode.

Column Heading	Outline
Define Name	This area allows you to assign a "user-defined pin name" to the pin. wITHIN 256 characters can be entered in the [Define Name].
Description	Displays the summary of function of the pin.
Recommend Connection for Unused	Displays instructions on how to handle the pin when it is not used. This column displays information only when the "Free" is selected in the "Function" column.
Attention	Displays the precaution on using the pin.
External Parts	This area is for selecting which external peripheral controller to connect the pin to.

Remarks 1. You cannot add information in the "Pin Number" column, "Pin Name" column, "Description" column, "Recommend Connection for Unused" column and "Attention" column because they contain fixed information.

2. If the "Free" in the "Function" column is changed to a specific pin name, color of the corresponding pin in the Device Top View panel changes from the "color representing the unused pins" to the "color representing the used pins" selected by clicking [Device Top View Settings] tab >> [Color] in the Property panel.

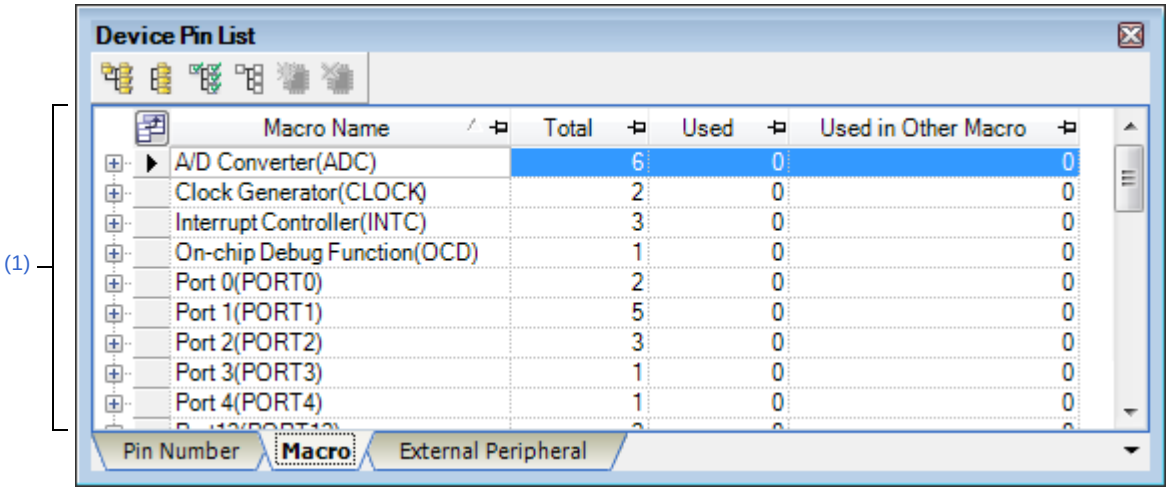
3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

4. To add the "user's own column", use the New Column dialog box which opens by pressing the [New Column...] button in the Column Chooser dialog box which opens by pressing the  button in the upper left corner of the device pin list.

[Macro] tab

This tab displays information on each pin of the microcontroller in the order it was grouped into peripheral functions.

Figure A-16. [Macro] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List].
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then press the [Enter] key.
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Device pin list area

This area displays the "device pin list" for entering information on the pins of the microcontroller.
The device pin list in this area is organized in the order the pins were grouped into peripheral functions.

(a) First layer

The following are the columns comprising the device pin list.

Column Heading	Outline
Macro Name	Displays the name of the peripheral function.
Total	Displays the total number of pins assigned to the peripheral function.
Used	Displays the total number of pins for which the purpose has been set.
Used in Other Macro	Displays the total number of pins for which the purpose has been set by other peripheral functions.

(b) Second layer

Column Heading	Outline
Pin Number	Displays the pin number of the pin.
Pin Name	Displays the pin name of the pin.
Function	This area allows you to select "which function to use" when the pin has more than one functions.
I/O	This area allows you to select the I/O mode of the pin.
N-ch	This area allows you to select "which output mode to apply" when using the pin in the output mode.
Define Name	This area allows you to assign a "user-defined pin name" to the pin. Within 256 characters can be entered in the [Define Name].
Description	Displays the summary of function of the pin.
Recommend Connection for Unused	Displays instructions on how to handle the pin when it is not used. This column displays information only when the "Free" is selected in the "Function" column.
Attention	Displays the precaution on using the pin.
External Parts	This area is for selecting which external peripheral controller to connect the pin to.

Remarks 1. You cannot add information in the "Macro Name", "Total", "Used", "Used by other function", "Pin Number", "Pin Name", "Description", "Recommend Connection for Unused" and "Attention" columns because they contain fixed information.

2. If the "Free" in the "Function" column is changed to a specific pin name, color of the corresponding pin in the Device Top View panel changes from the "color representing the unused pins" to the "color representing the used pins" selected by clicking [Device Top View Settings] tab >> [Color] in the Property panel.

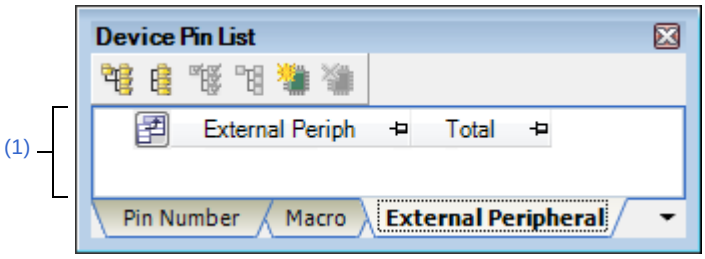
3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

4. To add the "user's own column", use the New Column dialog box which opens by pressing the [New Column...] button in the Column Chooser dialog box which opens by pressing the  button in the upper left corner of the device pin list.

[External Peripheral] tab

This tab displays information about the pins connected to external peripherals in order grouped at the external-peripheral component level.

Figure A-17. [External Peripheral] Tab



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List].
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List], and then press the [Enter] key.
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Device pin list area

This area displays the "device pin list" for entering information on the pins connected to external peripheral parts. Note that items in this area's device pin list are sorted by groups at the external peripheral controller level.

(a) First layer

The following are the columns comprising the device pin list.

Column Heading	Outline
External Peripheral	Displays the name of the external peripheral controller. To change the name, select this field and then press the [F2] key.
Total	Displays the total number of pins allocated for connection with the microcontroller.

(b) Second layer

Column Heading	Outline
Pin Number	Displays the pin number of the pin.
Pin Name	Displays the pin name of the pin.

Column Heading	Outline
Function	This area allows you to select "which function to use" when the pin has more than one functions.
I/O	This area allows you to select the I/O mode of the pin.
N-ch	This area allows you to select "which output mode to apply" when using the pin in the output mode.
Define Name	This area allows you to assign a "user-defined pin name" to the pin. Within 256 characters can be entered in the [Define Name].
Description	Displays the summary of function of the pin.
Recommend Connection for Unused	Displays instructions on how to handle the pin when it is not used. This column displays information only when the "Free" is selected in the "Function" column.
Attention	Displays the precaution on using the pin.

Remarks 1. You cannot add information in the "External Peripheral Name", "Connected Pins", "Pin Number", "Pin Name", "Description", "Recommend Connection for Unused" and "Attention" columns because they contain fixed information.

2. If the "Free" in the "Function" column is changed to a specific pin name, color of the corresponding pin in the Device Top View panel changes from the "color representing the unused pins" to the "color representing the used pins" selected by clicking [Device Top View Settings] tab >> [Color] in the Property panel.

3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

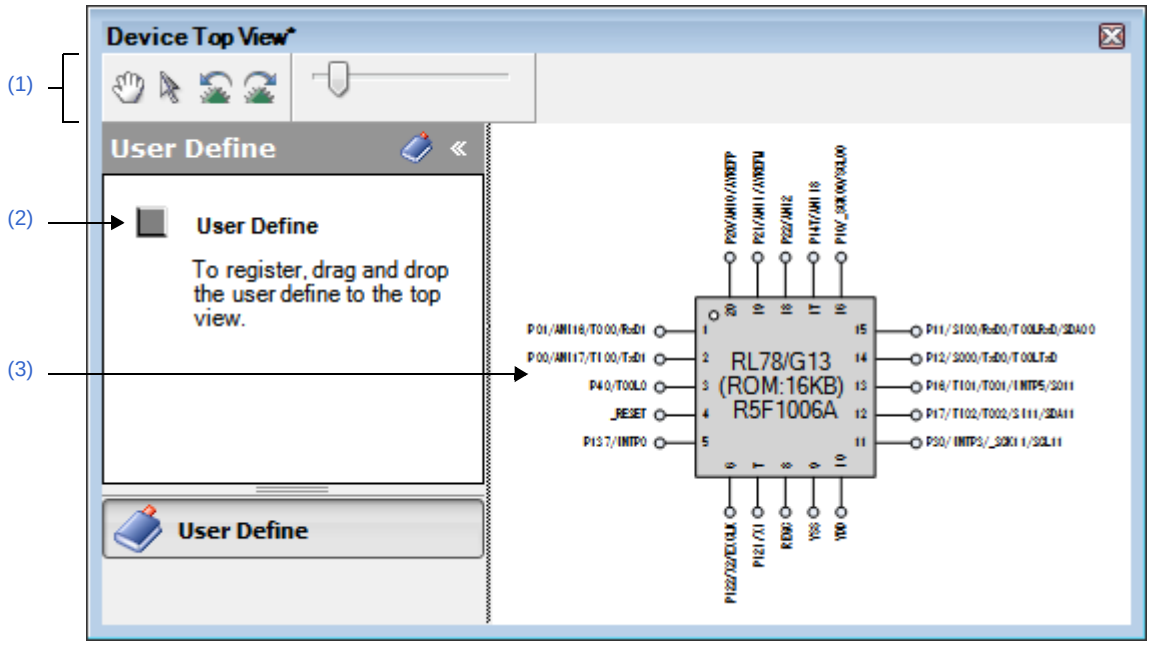
4. To add the "user's own column", use the New Column dialog box which opens by pressing the [New Column...] button in the Column Chooser dialog box which opens by pressing the  button in the upper left corner of the device pin list.

Device Top View panel

This panel displays the information entered in the Device Pin List panel.

Remark The Device top view area can be zoomed in and out by 50% in the tool bar.

Figure A-18. Device Top View Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [Context menu]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View].
- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View], and then press the [Enter] key.
- From the [View] menu, select [Pin Configurator] >> [Device Top View].

Remark In the Property panel, on the [Pin Configurator Settings] tab >> [Package >> [Package type]], if "BGA" is selected, then this panel cannot be opened.

[Description of each area]

(1) Toolbar

This area consists of the following buttons.

	Clicks this button to enable changing of the display in the Device top view area by drag and drop. By pressing this button, the shape of the mouse cursor in the Device top view area changes from the arrow to the hand.
	Clicks this button to enable moving external peripheral components in the Device top view area to arbitrary locations, and select pins. By pressing this button, the shape of the mouse cursor which has changed into the hand by pressing the  button reverts back to the arrow.
	Rotates the content in the Device top view area 90 degrees counter-clockwise.
	Rotates the content in the Device top view area 90 degrees clockwise.
	Expands or reduces the content in the Device top view area.

(2) [User Define] area

Drag and drop the  button from this area to the Device top view area to creat and display an external peripheral controller.

(3) Device top view area

This area displays the pin assignment of the microcontroller.

Settings of the pin assignment are displayed using the colors specified by selecting [Device Top View Settings] tab >> [Color] in the Property panel.

Remark If the pin name in the diagram is double-clicked, the Device Pin List panel opens and the focus moves to the clicked pin in the list.

[Context menu]

When you right click on a pin or external peripheral controller in the Device top view area, the following context menu displays.

(1) When a pin is right clicked

Use as	If the pin has multiple functions, select which function to use.
Connect to External Peripheral	Selects which external peripheral controller to connect the pin to.

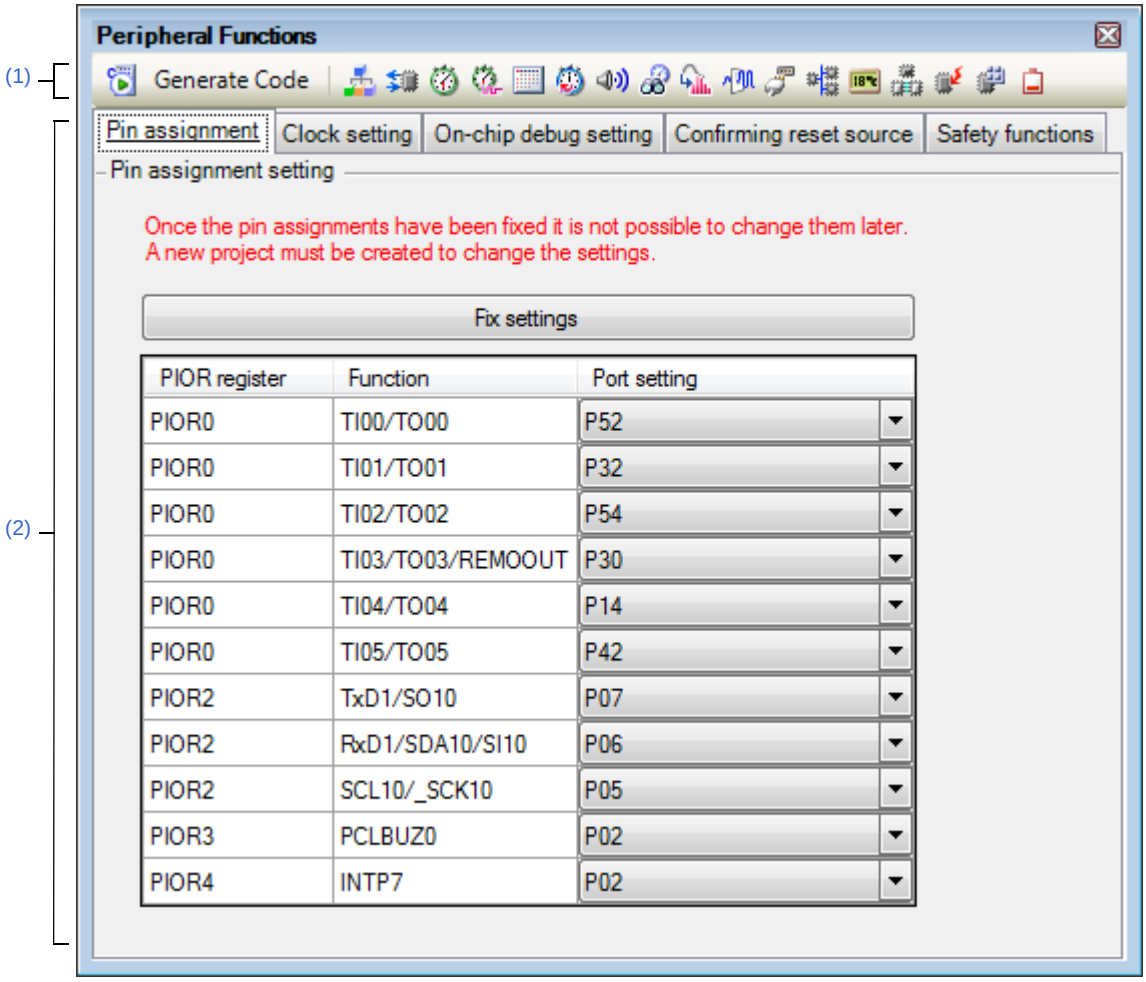
(2) When an external peripheral controller is right clocked

Disconnect Pin	Disconnects from the pin.
Delete External Peripheral	Removes the external peripheral controller.

Peripheral Functions panel

This panel allows you to configure the information necessary to control the peripheral functions (clock generator, port functions, etc.) provided.

Figure A-19. Peripheral Functions Panel



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] (>> Peripheral function node).
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Peripheral Functions] (>> Peripheral function node), and then press the [Enter] key.
- From the [View] menu >> [Code Generator 2], select [Peripheral Functions].

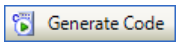
Remark If this panel is already open, pressing a different peripheral function button "  ,  , etc." changes the content displayed in the Information setting area accordingly.

[Description of each area]

(1) Toolbar

This area consists of the following "peripheral function buttons".

When there is peripheral function target microcontroller is not supporting, peripheral functionbutton is not disokayed.

	Outputs the source code (device driver program) to the folder specified by selecting [Code Generator Setting] tab >> [Generate File Mode] >> [Output folder] in the Property panel.
 ,  , etc.	Changes the content displayed in the Information setting area to information required for controlling peripheral functions.

(2) Information setting area

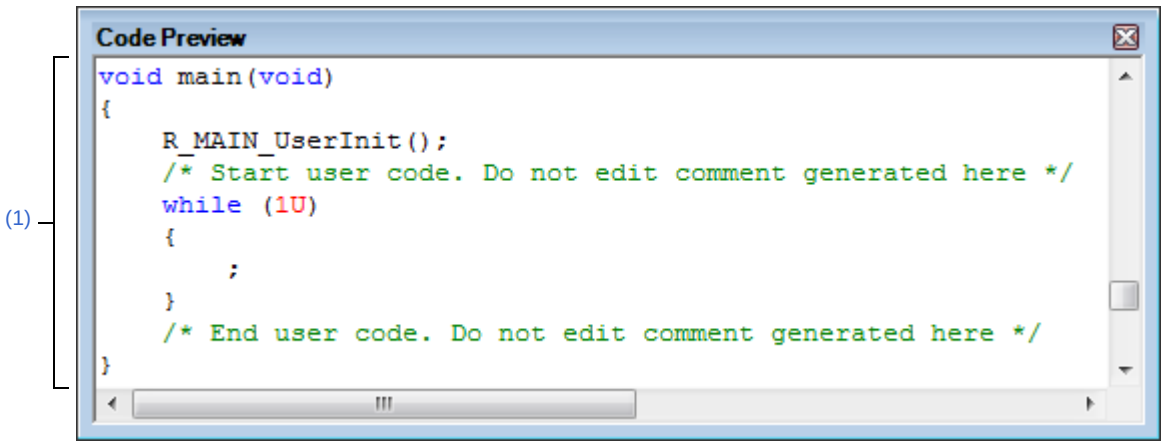
The content displayed in this area differs depending on the "peripheral function node" or "peripheral function button" selected or pressed when opening this panel.

See user's manual for microcontroller for details on the items to be set.

Code Preview panel

This panel allows you to confirm the source code in accord with the settings of the Peripheral Functions panel.

Figure A-20. Code Preview Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [Context menu]

[How to open]

- On the Project Tree panel, double-click [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node (>> API function node).
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Code Preview] >> Peripheral function node >> Source code node (>> API function mode), and then press the [Enter] key.
- From the [View] menu >> [Code Generator 2], select [Code Preview].

Remark If this panel is already open, double-clicking the source code node (>> API function node) changes the content displayed in the Source code display area to that corresponding to the selected node.

[Description of each area]

(1) Source code display area

This area allows you to confirm the source code (device driver program) that reflects the information configured in the Peripheral Functions panel.

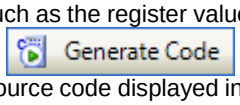
The following table displays the meaning of the color of the source code text displayed in this area.

Table A-2. Color of Source Code

Color	Outline
Green	Comment
Blue	Reserved word for C compiler
Red	Numeric value
Black	Code section

Color	Outline
Gray	File name

Remarks 1. You cannot edit the source code within this panel.

2. For some of the API functions, values such as the register value are calculated and finalized when the source code is generated (when the 

button on the Peripheral Functions panel is pressed). For this reason, the source code displayed in this panel may not be the same as that would actually be generated.

[Context menu]

The following context menu items are displayed by right clicking the mouse.

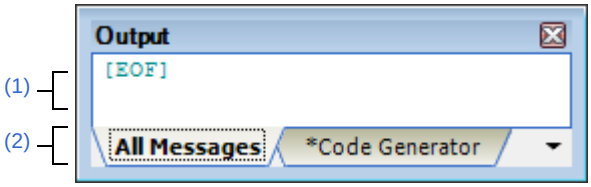
Copy	Sends the character string or lines selected with range selection to the clipboard.
Select All	Selects all the messages displayed on the Source code display area.

Output panel

This panel displays operation logs for various components (design tool, build tool, etc.) provided by CubeSuite+.
The messages are classified by the message origination tool and displayed on the individual tabs.

Remark The Message area can be zoomed in and out by 100% in the tool bar, or by operating the mouse wheel while holding down the [Ctrl] key.

Figure A-21. Output Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [Context menu]

[How to open]

- From the [View] menu, select [Output].

[Description of each area]

(1) Message area

The output messages of each tool are displayed.
Note that the character colors/background colors of the message differ with the type of output message (and depend on the settings in the [General - Font and Color] category in the Option dialog box).

(2) Tab selection area

Select the tab that indicates the origin of message.
The following tabs are available for the debug tool.

Tab Name	Description
All Messages	Displays operation logs for all components (design tool, build tool, etc.) provided by CubeSuite+ in order of output.
Code Generator	Display only operation logs for the Code Generator out of those for various components (design tool, build tool, etc.) provided by CubeSuite+.

Caution Even if a new message is output on a deselected tab, tab selection will not automatically switch. In this case, " * " mark will be added in front of the tab name, indicating that a new message has been output.

[Context menu]

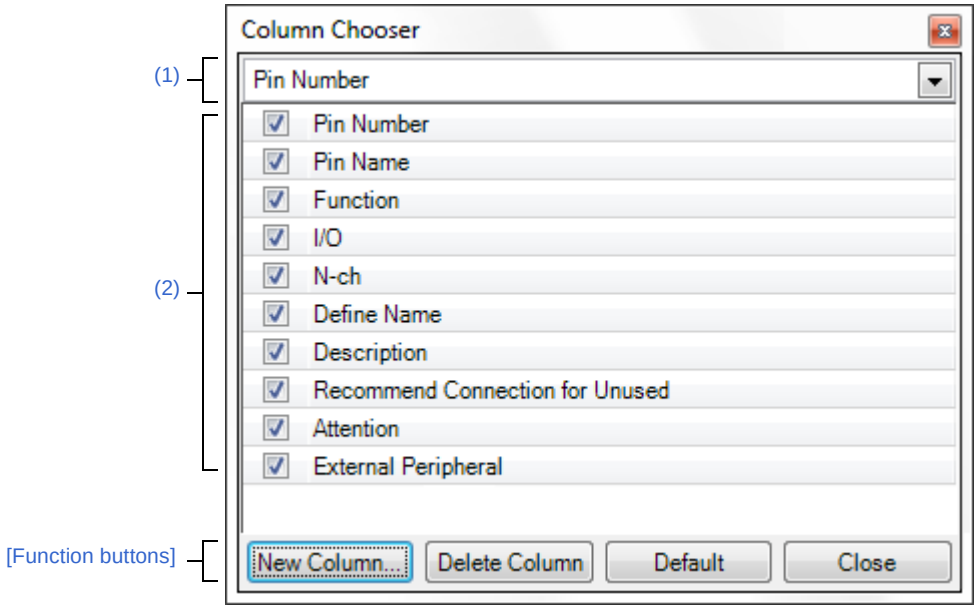
The following context menu items are displayed by right clicking the mouse.

Copy	Sends the character string or lines selected with range selection to the clipboard.
Select All	Selects all the messages displayed on the Message area.
Clear	Deletes all the messages displayed on the Message area.
Tag Jump	Jumps to the caret line in the editor indicated by the message (file, line, and column).
Open Help for Message	Displays help for the message on the current caret location. This only applies to warning messages and error messages.

Column Chooser dialog box

This dialog box allows you to choose whether or not to display the item listed in this dialog box in the device pin list, and add columns to or delete columns from the device pin list.

Figure A-22. Column Chooser Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- In the [Pin Number] tab of the Device Pin List panel, click the button.
- In the [Macro] tab of the Device Pin List panel, click the button.
- In the [External Peripheral] tab of the Device Pin List panel, click the button.

[Description of each area]

(1) Operational object selection area

This area allows you to select the device pin list to be configured in this dialog box.

Pin Number	Configures the device pin list corresponding to the [Pin Number] tab.
Macro	Configures the device pin list belonging to the first layer of the [Macro] tab.
Macro - Pin	Configures the device pin list belonging to the second layer of the [Macro] tab.
External Peripheral	Configures the device pin list belonging to the first layer of the [External Peripheral] tab.
External Peripheral - Pin	Configures the device pin list belonging to the second layer of the [External Peripheral] tab.

(2) Displayed item selection area

Select whether or not to display the item selected in the Operational object selection area in the device pin list.

Checked	Displays the selected item in the device pin list.
Not checked	Hides the selected item in the device pin list.

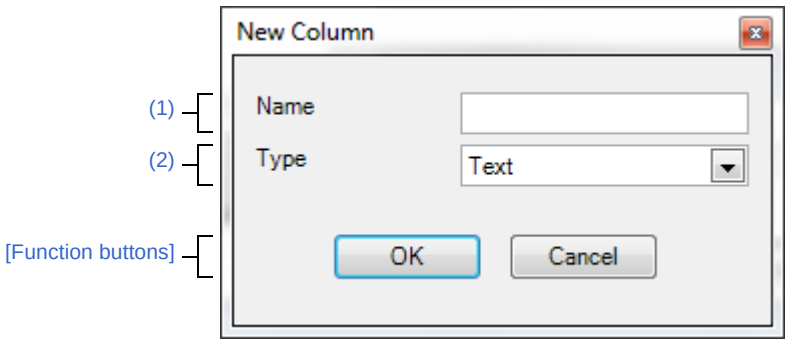
[Function buttons]

Button	Function
New Column...	Opens the New Column dialog box for adding columns to the device pin list.
Delete Column	Deletes the selected columns from the device pin list. You can only delete the column which you added using the New Column dialog box.
Default	Restores the column order to the default settings.
Close	Closes this dialog box.

New Column dialog box

This dialog box allows you to add your own column to the device pin list.

Figure A-23. New Column Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- Click the [New Column...] button in the Column Chooser dialog box.

[Description of each area]

(1) [Name]

This area allows you to enter column headings of the columns added to the device pin list.
Witnin 256 characters can be entered in the [Name].

(2) [Type]

Select the input format of the column to add to the device pin list.

Text	Only character strings can be entered in the column.
Cehck box	Adds a column of check boxes.
Whole number	Only integers can be entered in the column.
Real number	Only real numbers can be entered in the column.
Date	Only dates in YYYYMMDD format can be entered in the column.

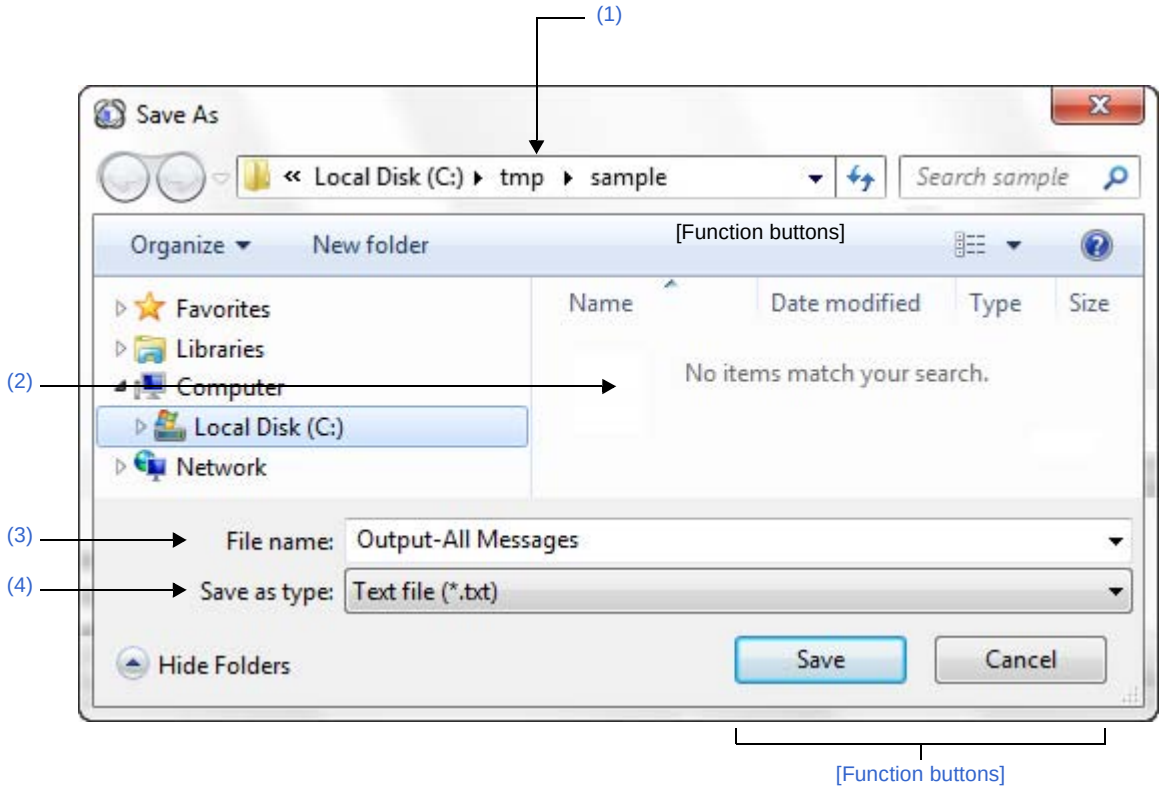
[Function buttons]

Button	Function
OK	Adds a column that has the column heading specified in the [Name] to the right end of the device pin list.
Cancel	Ignores the setting and closes this dialog box.

Save As dialog box

This dialog box allows you to name and save a file.

Figure A-24. Save As Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [File] menu, select [Save Output-*Tab Name*].
- From the [File] menu, select [Save Output-*Tab Name* As...].

[Description of each area]

(1) Folder location

This is for selection of the output destination folder (folder name).

(2) List of files

This area displays a list of files matching the conditions selected in Folder location and [Save as type].

(3) [File name]

Specify the name of the file (file name).

(4) [Save as type]

Select the type of the file (file type).

[Function buttons]

Button	Function
Save	Outputs a file having the name specified in the [File name] and [Save as type] to the folder specified in the Folder location.
Cancel	Ignores the setting and closes this dialog box.

APPENDIX B OUTPUT FILES

This appendix describes the files output by the Code Generator.

B.1 Description

Below is a list of output file files by the Code Generator.

Table B-1. Output File List

Peripheral Function	File Name	API Function Name
Common	r_main.c or r_cg_main.c	main R_MAIN_UserInit
	r_systeminit.c or r_cg_systeminit.c	hdwinit R_Systeminit
	r_cg_macrodriver.h	-
	r_cg_userdefine.h	-
	r_cg_lk.dr	-
Clock generator	r_cg_cgc.c	R_CGC_Create R_CGC_Set_ClockMode R_CGC_Set_CRCOn R_CGC_RAMECC_Start R_CGC_RAMECC_Stop R_CGC_StackPointer_Start R_CGC_StackPointer_Stop R_CGC_ClockMonitor_Start R_CGC_ClockMonitor_Stop
	r_cg_cgc_user.c	R_CGC_Create_UserInit r_cgc_ram_ecc_interrupt r_cgc_stackpointer_interrupt r_cgc_clockmonitor_interrupt R_CGC_Get_ResetSource
	r_cg_cgc.h	-
Port functions	r_cg_port.c	R_PORT_Create
	r_cg_port_user.c	R_PORT_Create_UserInit
	r_cg_port.h	-

Peripheral Function	File Name	API Function Name
Timer array unit	r_cg_timer.c or r_cg_tau.c	R_TAUm_Create R_TAUm_Channeln_Start R_TAUm_Channeln_Higher8bits_Start R_TAUm_Channeln_Lower8bits_Start R_TAUm_Channeln_Stop R_TAUm_Channeln_Higher8bits_Stop R_TAUm_Channeln_Lower8bits_Stop R_TAUm_Set_PowerOff R_TAUm_Channeln_Get_PulseWidth R_TAUm_Channeln_Set_SoftwareTriggerOn
	r_cg_timer_user.c or r_cg_tau_user.c	R_TAUm_Create_UserInit r_taum_channeln_interrupt r_taum_channeln_higher8bits_interrupt
	r_cg_timer.h or r_cg_tau.h	-
Timer RJ	r_cg_timer.c	R_TMR_RJ0_Create R_TMR_RJ0_Start R_TMR_RJ0_Stop R_TMR_RJ0_Set_PowerOff R_TMR_RJ0_Get_PulseWidth
	r_cg_timer_user.c	R_TMR_RJ0_Create_UserInit r_tmr_rj0_interrupt
	r_cg_timer.h	-
Timer RD	r_cg_timer.c	R_TMR_RDn_Create R_TMR_RDn_Start R_TMR_RDn_Stop R_TMR_RDn_Set_PowerOff R_TMR_RDn_ForcedOutput_Start R_TMR_RDn_ForcedOutput_Stop R_TMR_RDn_Get_PulseWidth
	r_cg_timer_user.c	R_TMR_RDn_Create_UserInit r_tmr_rdn_interrupt
	r_cg_timer.h	-
Timer RG	r_cg_timer.c	R_TMR_RG0_Create R_TMR_RG0_Start R_TMR_RG0_Stop R_TMR_RG0_Set_PowerOff R_TMR_RG0_Get_PulseWidth
	r_cg_timer_user.c	R_TMR_RG0_Create_UserInit r_tmr_rg0_interrupt
	r_cg_timer.h	-

Peripheral Function	File Name	API Function Name
16-bit timer KB	r_cg_timer.c	R_TMR_KB_Create R_TMR_KBm_Start R_TMR_KBm_Stop R_TMR_KBm_Set_PowerOff R_TMR_KBmn_ForcedOutput_Start R_TMR_KBmn_ForcedOutput_Stop R_TMR_KBm_BatchOverwriteRequestOn
	r_cg_timer_user.c	R_TMR_KBm_Create_UserInit r_tmr_kbm_interrupt
	r_cg_timer.h	-
16-bit timer KC0	r_cg_timer.c	R_TMR_KC0_Create R_TMR_KC0_Start R_TMR_KC0_Stop R_TMR_KC0_Set_PowerOff
	r_cg_timer_user.c	R_TMR_KC0_Create_UserInit r_tmr_kc0_interrupt
	r_cg_timer.h	-
16-bit timer KB2	r_cg_kb2.c	R_KB2m_Create R_KB2m_Start R_KB2m_Stop R_KB2m_Set_PowerOff R_KB2m_Simultaneous_Start R_KB2m_Simultaneous_Stop R_KB2m_Synchronous_Start R_KB2m_Synchronous_Stop R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Start R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Stop R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Start R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Stop R_KB2m_TKBOn0_DitheringFunction_Start R_KB2m_TKBOn0_DitheringFunction_Stop R_KB2m_TKBOn1_DitheringFunction_Start R_KB2m_TKBOn1_DitheringFunction_Stop R_KB2m_TKBOn0_SmoothStartFunction_Start R_KB2m_TKBOn0_SmoothStartFunction_Stop R_KB2m_TKBOn1_SmoothStartFunction_Start R_KB2m_TKBOn1_SmoothStartFunction_Stop R_KB2m_Set_BatchOverwriteRequestOn
	r_cg_kb2_user.c	R_KB2m_Create_UserInit r_kb2m_interrupt
	r_cg_kb2.h	-

Peripheral Function	File Name	API Function Name
Real-time clock	r_cg_rtc.c	R_RTC_Create R_RTC_Start R_RTC_Stop R_RTC_Set_PowerOff R_RTC_Set_HourSystem R_RTC_Set_CounterValue R_RTC_Get_CounterValue R_RTC_Set_ConstPeriodInterruptOn R_RTC_Set_ConstPeriodInterruptOff R_RTC_Set_AlarmOn R_RTC_Set_AlarmOff R_RTC_Set_AlarmValue R_RTC_Get_AlarmValue R_RTC_Set_RTC1HZOn R_RTC_Set_RTC1HZOff
	r_cg_rtc_user.c	R_RTC_Create_UserInit r_rtc_interrupt r_rtc_callback_constperiod r_rtc_callback_alarm
	r_cg_rtc.h	-
Subsystem clock frequency measurement circuit	r_cg_fmc.c	R_FMC_Create R_FMC_Start R_FMC_Stop R_FMC_Set_PowerOff
	r_cg_fmc_user.c	R_FMC_Create_UserInit r_fmc_interrupt
	r_cg_fmc.h	-
12-bit interval timer	r_cg_it.c	R_IT_Create R_IT_Start R_IT_Stop R_IT_Set_PowerOff
	r_cg_it_user.c	R_IT_Create_UserInit r_it_interrupt
	r_cg_it.h	-
8-bit interval timer	r_cg_it8bit.c	R_IT8bitm_Channeln_Create R_IT8bitm_Channeln_Start R_IT8bitm_Channeln_Stop R_IT8bitm_Channeln_Set_PowerOff
	r_cg_it8bit_user.c	R_IT8bitm_Channeln_Create_UserInit r_it8bitm_channeln_interrupt
	r_cg_it8bit.h	-

Peripheral Function	File Name	API Function Name
16-bit wakeup timer	r_cg_timer.c	R_WUTM_Create R_WUTM_Start R_WUTM_Stop R_WUTM_Set_PowerOff
	r_cg_timer_user.c	R_WUTM_Create_UserInit r_wutm_interrupt
	r_cg_timer.h	-
Clock output/buzzer output controller	r_cg_pclbuz.c	R_PCLBUZn_Create R_PCLBUZn_Start R_PCLBUZn_Stop R_PCLBUZ_Set_PowerOff
	r_cg_pclbuz_user.c	R_PCLBUZn_Create_UserInit
	r_cg_pclbuz.h	-
Watchdog timer	r_cg_wdt.c	R_WDT_Create R_WDT_Restart
	r_cg_wdt_user.c	R_WDT_Create_UserInit r_wdt_interrupt
	r_cg_wdt.h	-
A/D converter	r_cg_adc.c	R_ADC_Create R_ADC_Set_OperationOn R_ADC_Set_OperationOff R_ADC_Start R_ADC_Stop R_ADC_Set_PowerOff R_ADC_Set_ADChannel R_ADC_Set_SnoozeOn R_ADC_Set_SnoozeOff R_ADC_Set_TestChannel R_ADC_Get_Result R_ADC_Get_Result_8bit
	r_cg_adc_user.c	R_ADC_Create_UserInit r_adc_interrupt
	r_cg_adc.h	-
Temperature sensor	r_cg_tmps.c	R_TMPS_Create R_TMPS_Start R_TMPS_Stop R_TMPS_Set_PowerOff
	r_cg_tmps_user.c	R_TMPS_Create_UserInit
	r_cg_tmps.h	-

Peripheral Function	File Name	API Function Name
24-bit DS A/D converter	r_cg_dsadc.c	R_DSADC_Create R_DSADC_Set_OperationOn R_DSADC_Set_OperationOff R_DSADC_Start R_DSADC_Stop R_DSADC_Set_PowerOff R_DSADC_Channeln_Get_Result R_DSADC_Channeln_Get_Result_16bit
	r_cg_dsadc_user.c	R_DSADC_Create_UserInit r_dsadc_interrupt
	r_cg_dsadc.h	-
D/A converter	r_cg_dac.c	R_DAC_Create R_DACn_Start R_DACn_Stop R_DAC_Set_PowerOff R_DACn_Set_ConversionValue
	r_cg_dac_user.c	R_DAC_Create_UserInit
	r_cg_dac.h	-
Programmable gain amplifier	r_cg_pga.c	R_PGA_Create R_PGA_Start R_PGA_Stop
	r_cg_pga_user.c	R_PGA_Create_UserInit
	r_cg_pga.h	-
Comparator	r_cg_comp.c	R_COMP_Create R_COMPn_Start R_COMPn_Stop R_COMP_Set_PowerOff
	r_cg_comp_user.c	R_COMP_Create_UserInit r_compn_interrupt
	r_cg_comp.h	-

Peripheral Function	File Name	API Function Name
Serial array unit	r_cg_serial.c or r_cg_sau.c	R_SAUm_Create R_SAUm_Set_PowerOff R_SAUm_Set_SnoozeOn R_SAUm_Set_SnoozeOff R_UARTn_Create R_UARTn_Start R_UARTn_Stop R_UARTn_Send R_UARTn_Receive R_CSImn_Create R_CSImn_Start R_CSImn_Stop R_CSImn_Send R_CSImn_Receive R_CSImn_Send_Receive R_IICmn_Create R_IICmn_StartCondition R_IICmn_StopCondition R_IICmn_Stop R_IICmn_Master_Send R_IICmn_Master_Receive
	r_cg_serial_user.c or r_cg_sau_user.c	R_SAUm_Create_UserInit r_uartn_interrupt_send r_uartn_interrupt_receive r_uartn_interrupt_error r_uartn_callback_sendend r_uartn_callback_receiveend r_uartn_callback_error r_uartn_callback_softwareoverrun r_csimn_interrupt r_csimn_callback_sendend r_csimn_callback_receiveend r_csimn_callback_error r_iicmn_interrupt r_iicmn_callback_master_sendend r_iicmn_callback_master_receiveend r_iicmn_callback_master_error
	r_cg_serial.h or r_cg_sau.h	-

Peripheral Function	File Name	API Function Name
Serial array unit 4 (DALI/ UART4)	r_cg_serial.c	R_DALIn_Create R_DALIn_Start R_DALIn_Stop R_DALIn_Send R_DALIn_Receive
	r_cg_serial_user.c	r_dalin_interrupt_send r_dalin_interrupt_receive r_dalin_interrupt_error r_dalin_callback_sendend r_dalin_callback_receiveend r_dalin_callback_error r_dalin_callback_softwareoverrun
	r_cg_serial.h	-
Asynchronous serial interface LIN-UART (UARTF)	r_cg_serial.c	R_UARTFn_Create R_UARTFn_Start R_UARTFn_Stop R_UARTFn_Set_PowerOff R_UARTFn_Send R_UARTFn_Receive R_UARTFn_Set_DataComparisonOn R_UARTFn_Set_DataComparisonOff
	r_cg_serial_user.c	R_UARTFn_Create_UserInit r_uartfn_interrupt_send r_uartfn_interrupt_receive r_uartfn_interrupt_error r_uartfn_callback_sendend r_uartfn_callback_receiveend r_uartfn_callback_error r_uartfn_callback_softwareoverrun r_uartfn_callback_expbitdetect r_uartfn_callback_idmatch
	r_cg_serial.h	-

Peripheral Function	File Name	API Function Name
Serial interface IICA	r_cg_serial.c or r_cg_iica.c	R_IICAn_Create R_IICAn_StopCondition R_IICAn_Stop R_IICAn_Set_PowerOff R_IICAn_Master_Send R_IICAn_Master_Receive R_IICAn_Slave_Send R_IICAn_Slave_Receive R_IICAn_Set_SnoozeOn R_IICAn_Set_SnoozeOff R_IICAn_Set_WakeupOn R_IICAn_Set_WakeupOff
	r_cg_serial_user.c or r_cg_iica_user.c	R_IICAn_Create_UserInit r_iican_interrupt r_iican_callback_master_sendend r_iican_callback_master_receiveend r_iican_callback_master_error r_iican_callback_slave_sendend r_iican_callback_slave_receiveend r_iican_callback_slave_error r_iican_callback_getstopcondition
	r_cg_serial.h or r_cg_iica.h	-
LCD controller/driver	r_cg_lcd.c	R_LCD_Create R_LCD_Start R_LCD_Stop R_LCD_Set_VoltageOn R_LCD_Set_VoltageOff R_LCD_Set_PowerOff
	r_cg_lcd_user.c	R_LCD_Create_UserInit r_lcd_interrupt
	r_cg_lcd.h	-
Sound generator	r_cg_sg.c	R_SG_Create R_SG_Start R_SG_Stop
	r_cg_sg_user.c	R_SG_Create_UserInit r_sg_interrupt
	r_cg_sg.h	-

Peripheral Function	File Name	API Function Name
DMA controller	r_cg_dmac.c	R_DMACn_Create R_DMAC_Create R_DMACn_Start R_DMACn_Stop R_DMACn_Set_SoftwareTriggerOn
	r_cg_dmac_user.c	R_DMACn_Create_UserInit R_DMAC_Create_UserInit r_dmacn_interrupt
	r_cg_dmac.h	-
DTC	r_cg_dtc.c	R_DTC_Create R_DTCn_Start R_DTCn_Stop R_DTC_Set_PowerOff
	r_cg_dtc_user.c	R_DTC_Create_UserInit
	r_cg_dtc.h	-
Event link controller (ELC)	r_cg_elc.c	R_ELC_Create R_ELC_Stop
	r_cg_elc_user.c	R_ELC_Create_UserInit
	r_cg_elc.h	-
Interrupt functions	r_cg_intc.c	R_INTC_Create R_INTCn_Start R_INTCn_Stop R_INTCLRn_Start R_INTCLRn_Stop
	r_cg_intc_user.c	R_INTC_Create_UserInit r_intcn_interrupt r_intclrn_interrupt
	r_cg_intc.h	-
Key interrupt function	r_cg_intc.c	R_KEY_Create R_KEY_Start R_KEY_Stop
	r_cg_intc_user.c	R_KEY_Create_UserInit r_key_interrupt
	r_cg_intc.h	-
Voltage detector	r_cg_lvd.c	R_LVD_Create R_LVD_InterruptMode_Start
	r_cg_lvd_user.c	R_LVD_Create_UserInit r_lvd_interrupt
	r_cg_lvd.h	-

Peripheral Function	File Name	API Function Name
Battery backup function	r_cg_bup.c	R_BUP_Create R_BUP_Start R_BUP_Stop
	r_cg_bup_user.c	R_BUP_Create_UserInit r_bup_interrupt
	r_cg_bup.h	-
Oscillation stop detector	r_cg_osdc.c	R_OSDC_Create R_OSDC_Start R_OSDC_Stop R_OSDC_Set_PowerOff
	r_cg_osdc_user.c	R_OSDC_Create_UserInit r_osdc_interrupt
	r_cg_osdc.h	-
SPI interface	r_cg_saic.c	R_SAIC_Create R_SAIC_Write R_SAIC_Read
	r_cg_saic_user.c	R_SAIC_Create_UserInit
	r_cg_saic.h	-

APPENDIX C API FUNCTIONS

This appendix describes the API functions output by the Code Generator.

C.1 Overview

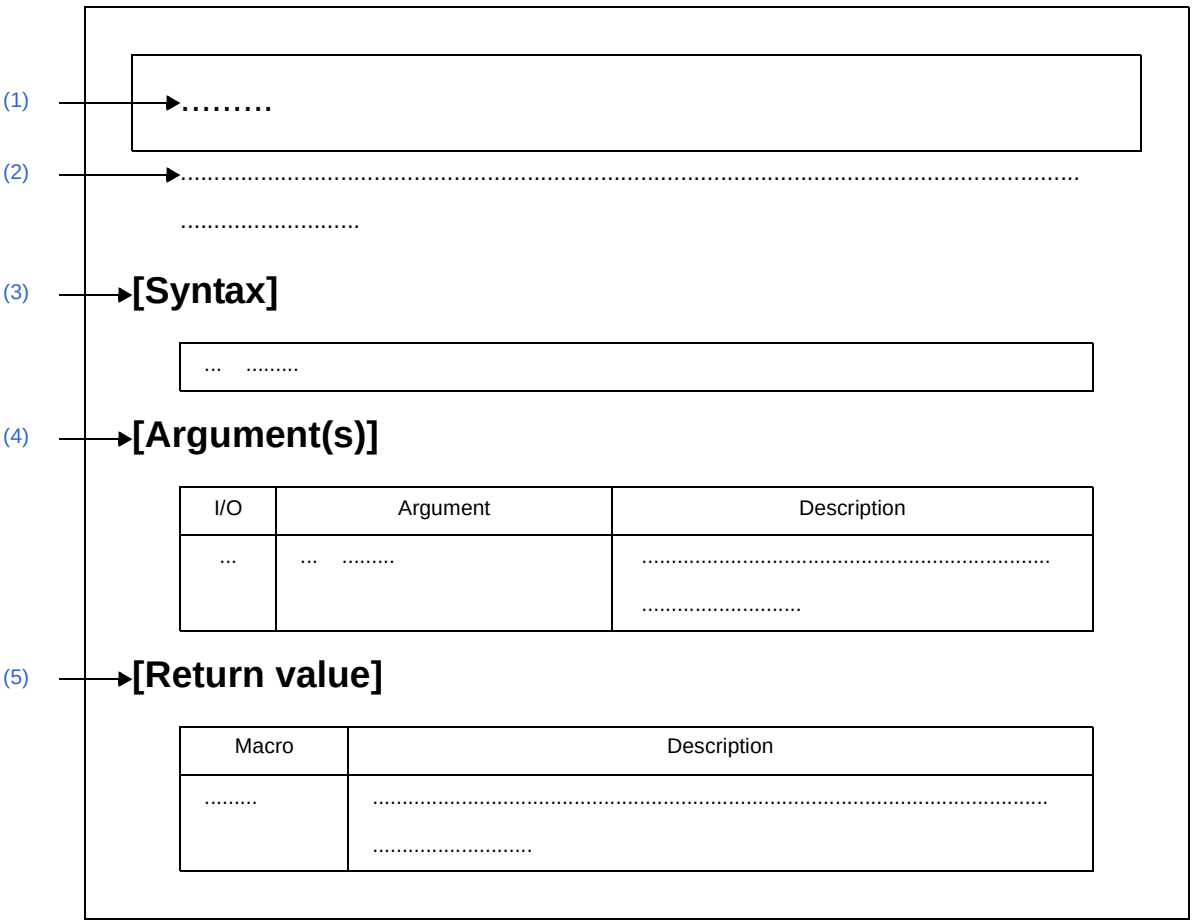
Below are the naming conventions for API functions output by the Code Generator.

- Macro names are in ALL CAPS.
  The number in front of the macro name is a hexadecimal value; this is the same value as the macro value.
- Local variable names are in all lower case.
- Global variable names start with a "g" and use Camel Case.
- Names of pointers to global variables start with a "gp" and use Camel Case.
- Names of elements in enum statements are in ALL CAPS.

C.2 Function Reference

This section describes the API functions output by the Code Generator, using the following notation format.

Figure C-1. Notation Format of API Functions



(1) Name

Indicates the name of the API function.

(2) Outline

Outlines the functions of the API function.

(3) [Syntax]

Indicates the format to be used when describing an API function to be called in C language.

(4) [Argument(s)]

API function arguments are explained in the following format.

I/O	Argument	Description
(a)	(b)	(c)

(a) I/O

Argument classification

I ... Input argument

O ... Output argument

(b) Argument

Argument data type

(c) Description

Description of argument

(5) [Return value]

API function return value is explained in the following format.

Macro	Description
(a)	(b)

(a) Macro

Macro of return value

(b) Description

Description of return value

C.2.1 Common

Below is a list of API functions output by the Code Generator for common use.

Table C-1. API Functions: [Common]

API Function Name	Function
hdwinit	Performs initialization necessary to control the various hardwares.
R_Systeminit	Performs initialization necessary to control the various peripheral functions.
main	This is a main function.
R_MAIN_UserInit	Performs user-defined initialization.

hdwinit

Performs initialization necessary to control the various hardwares.

Remark Call this API function from the startup routine.

[Syntax]

```
void    hdwinit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_Systeminit

Performs initialization necessary to control the various peripheral functions.

Remark This API function is called as the hdwinit callback routine.

[Syntax]

```
void    R_Systeminit ( void );
```

[Argument(s)]

None.

[Return value]

None.

main

This is a main function.

Remark Call this API function from the startup routine.

[Syntax]

```
void    main ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_MAIN_UserInit

Performs user-defined initialization.

Remark This API function is called as the main callback routine.

[Syntax]

```
void    R_MAIN_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.2 Clock generator

Below is a list of API functions output by the Code Generator for clock generator (include reset function, on-chip debug function, etc.) use.

Table C-2. API Functions: [Clock Generator]

API Function Name	Function
R_CGC_Create	Performs initialization required to control the clock generator (include reset function, on-chip debug function, etc.).
R_CGC_Create_UserInit	Performs user-defined initialization relating to the clock generator (include reset function, on-chip debug function, etc.).
r_cgc_ram_ecc_interrupt	Performs processing in response to the RAM 1-bit correction/2-bit error detection interrupt INTRAM.
r_cgc_stackpointer_interrupt	Performs processing in response to the stackpointer overflow/underflow interrupt INTSPM.
r_cgc_clockmonitor_interrupt	Performs processing in response to the clock monitor interrupt INTCLM.
R_CGC_Get_ResetSource	Performs processing in response to RESET signal.
R_CGC_Set_ClockMode	Changes the CPU clock/peripheral hardware clock.
R_CGC_Set_CRCOn	Starts the CRC operation function.
R_CGC_RAMECC_Start	Starts the RAM-ECC function.
R_CGC_RAMECC_Stop	Ends the RAM-ECC function.
R_CGC_StackPointer_Start	Starts the CPU stack pointer monitor function.
R_CGC_StackPointer_Stop	Ends the CPU stack pointer monitor function.
R_CGC_ClockMonitor_Start	Starts the clock monitor.
R_CGC_ClockMonitor_Stop	Ends the clock monitor.

R_CGC_Create

Performs initialization required to control the clock generator (include reset function, on-chip debug function, etc.).

[Syntax]

```
void    R_CGC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_Create_UserInit

Performs user-defined initialization relating to the clock generator (include reset function, on-chip debug function, etc.).

Remark This API function is called as the R_CGC_Create callback routine.

[Syntax]

```
void    R_CGC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_cgc_ram_ecc_interrupt

Performs processing in response to the RAM 1-bit correction/2-bit error detection interrupt INTRAM.

Remark This API function is called as the interrupt process corresponding to the RAM 1-bit correction/2-bit error detection interrupt INTRAM.

[Syntax]

```
__interrupt static  void    r_cgc_ram_ecc_interrupt ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

r_cgc_stackpointer_interrupt

Performs processing in response to the stack pointer overflow/underflow interrupt INTSPM.

Remark This API function is called as the interrupt process corresponding to the stack pointer overflow/underflow interrupt INTSPM.

[Syntax]

```
__interrupt static  void    r_cgc_stackpointer_interrupt ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

r_cgc_clockmonitor_interrupt

Performs processing in response to the clock monitor interrupt INTCLM.

Remark This API function is called as the interrupt process corresponding to the clock monitor interrupt INTCLM.

[Syntax]

```
__interrupt static  void    r_cgc_clockmonitor_interrupt ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

R_CGC_Get_ResetSource

Performs processing in response to RESET signal.

[Syntax]

```
void    R_CGC_Get_ResetSource ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_Set_ClockMode

Changes the CPU clock/peripheral hardware clock.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_cgc.h"
MD_STATUS   R_CGC_Set_ClockMode ( clock_mode_t mode );
```

[Argument(s)]

I/O	Argument	Description
I	`clock_mode_t mode;`	Clock generator type HIOCLK: High-speed onchip oscillator SYSX1CLK: X1 clock SYSEXTCLK: External main system clock SUBXT1CLK: XT1 clock SUBEXTCLK: External subsystem clock

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR1	Exit with error (abend)
MD_ERROR2	Exit with error (abend)
MD_ERROR3	Exit with error (abend)
MD_ERROR4	Exit with error (abend)
MD_ARGERROR	Invalid argument specification

R_CGC_Set_CRCOn

Starts the CRC operation function.

[Syntax]

```
void    R_CGC_Set_CRCOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_RAMECC_Start

Starts the RAM-ECC function.

[Syntax]

```
void    R_CGC_RAMECC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_RAMECC_Stop

Ends the RAM-ECC function.

[Syntax]

```
void    R_CGC_RAMECC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_StackPointer_Start

Starts the CPU stack pointer function.

[Syntax]

```
void    R_CGC_StackPointer_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_StackPointer_Stop

Ends the CPU stack pointer function.

[Syntax]

```
void    R_CGC_StackPointer_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_ClockMonitor_Start

Starts the clock monitor.

[Syntax]

```
void    R_CGC_ClockMonitor_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_CGC_ClockMonitor_Stop

Ends the clock monitor.

[Syntax]

```
void    R_CGC_ClockMonitor_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.3 Port functions

Below is a list of API functions output by the Code Generator for port functions use.

Table C-3. API Functions: [Port Functions]

API Function Name	Function
R_PORT_Create	Performs initialization necessary to control the port functions.
R_PORT_Create_UserInit	Performs user-defined initialization relating to the port functions.

R_PORT_Create

Performs initialization necessary to control the port functions.

[Syntax]

```
void    R_PORT_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_PORT_Create_UserInit

Performs user-defined initialization relating to the port functions.

Remark This API function is called as the R_PORT_Create callback routine.

[Syntax]

```
void    R_PORT_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.4 Timer array unit

Below is a list of API functions output by the Code Generator for timer array unit use.

Table C-4. API Functions: [Timer Array Unit]

API Function Name	Function
R_TAUm_Create	Performs initialization necessary to control the timer array unit.
R_TAUm_Create_UserInit	Performs user-defined initialization relating to the timer array unit.
r_taum_channeln_interrupt	Performs processing in response to the timer interrupt INTTM*mn*.
r_taum_channeln_higher8bits_interrupt	Performs processing in response to the timer interrupt INTTM*mn*H.
R_TAUm_Channeln_Start	Starts the count for channel *n*.
R_TAUm_Channeln_Higher8bits_Start	Starts the count (higher 8-bit) for channel *n*.
R_TAUm_Channeln_Lower8bits_Start	Starts the count (lower 8-bit) for channel *n*.
R_TAUm_Channeln_Stop	Ends the count for channel *n*.
R_TAUm_Channeln_Higher8bits_Stop	Ends the count (higher 8-bit) for channel *n*.
R_TAUm_Channeln_Lower8bits_Stop	Ends the count (lower 8-bit) for channel *n*.
R_TAUm_Set_PowerOff	Halts the clock supplied to the timer array unit.
R_TAUm_Channeln_Get_PulseWidth	Captures the high/low-level width measured between pulses of the signal (pulses) input to the TI*mn* pin.
R_TAUm_Channeln_Set_SoftwareTriggerOn	Generates the trigger (software trigger) for one-shot pulse output.

R_TAU*m*_Create

Performs initialization necessary to control the timer array unit.

[Syntax]

```
void    R_TAUm_Create ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Create_UserInit

Performs user-defined initialization relating to the timer array unit.

Remark This API function is called as the R_TAUm_Create callback routine.

[Syntax]

```
void    R_TAUm_Create_UserInit ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

r_tau*m*_channel*n*_interrupt

Performs processing in response to the timer interrupt INTTM*mn*.

Remark This API function is called as the interrupt process corresponding to the timer interrupt INTTM*mn*.

[Syntax]

```
__interrupt static  void    r_taum_channeln_interrupt ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_tau*m*_channel*n*_higher8bits_interrupt

Performs processing in response to the timer interrupt INTTM*mn*H.

Remark This API function is called as the interrupt process corresponding to the timer interrupt INTTM*mn*H.

[Syntax]

```
__interrupt static  void    r_taum_channeln_higher8bits_interrupt ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Start

Starts the count for channel *n*.

Remark The time from the call to this API function to the start of counting depends on the type of the function in question (e.g. interval timer, square-wave output, or external event counter).

[Syntax]

```
void    R_TAUm_Channeln_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Higher8bits_Start

Starts the count (higher 8-bit) for channel *n*.

Remark This API function can only be called when the timer array unit is used as a 8-bit timer.

[Syntax]

```
void    R_TAUm_Channeln_Higher8bits_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Lower8bits_Start

Starts the count (lower 8-bit) for channel *n*.

Remarks 1. This API function can only be called when the timer array unit is used as a 8-bit timer.

2. The time from the call to this API function to the start of counting depends on the type of the function in question (e.g. interval timer, external event counter, or delay counter).

[Syntax]

```
void    R_TAUm_Channeln_Lower8bits_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Stop

Ends the count for channel *n*.

[Syntax]

```
void    R_TAUm_Channeln_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Higher8bits_Stop

Ends the count (higher 8-bit) for channel *n*.

Remark This API function can only be called when the timer array unit is used as a 8-bit timer.

[Syntax]

```
void    R_TAUm_Channeln_Higher8bits_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Lower8bits_Stop

Ends the count (lower 8-bit) for channel *n*.

Remark This API function can only be called when the timer array unit is used as a 8-bit timer.

[Syntax]

```
void    R_TAUm_Channeln_Lower8bits_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Set_PowerOff

Halts the clock supplied to the timer array unit.

Remark Calling this API function changes the timer array unit to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TAUm_Set_PowerOff ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TAU*m*_Channel*n*_Get_PulseWidth

Captures the high/low-level width measured between pulses of the signal (pulses) input to the TI*mn* pin.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_TAUm_Channeln_Get_PulseWidth ( uint32_t * const width );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint32_t * const width;`	Pointer to an area to store the measurement width (0x0 to 0x1FFFF)

[Return value]

None.

R_TAU*m*_Channel*n*_Set_SoftwareTriggerOn

Generates the trigger (software trigger) for one-shot pulse output.

[Syntax]

```
void    R_TAUm_Channeln_Set_SoftwareTriggerOn ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.2.5 Timer RJ

Below is a list of API functions output by the Code Generator for timer RJ use.

Table C-5. API Functions: [Timer RJ]

API Function Name	Function
R_TMR_RJ0_Create	Performs initialization necessary to control the 16-bit timer RJ0.
R_TMR_RJ0_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer RJ0.
r_tmr_rj0_interrupt	Performs processing in response to the timer interrupt.
R_TMR_RJ0_Start	Starts the count for 16-bit timer RJ0.
R_TMR_RJ0_Stop	Ends the count for 16-bit timer RJ0.
R_TMR_RJ0_Set_PowerOff	Halts the clock supplied to the 16-bit timer RJ0.
R_TMR_RJ0_Get_PulseWidth	Reads the pulse width of the 16-bit timer RJ0.

R_TMR_RJ0_Create

Performs initialization necessary to control the 16-bit timer RJ0.

[Syntax]

```
void    R_TMR_RJ0_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RJ0_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer RJ0.

Remark This API function is called as the R_TMR_RJ0_Create callback routine.

[Syntax]

```
void    R_TMR_RJ0_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_tmr_rj0_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_tmr_rj0_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RJ0_Start

Starts the count for 16-bit timer RJ0.

[Syntax]

```
void    R_TMR_RJ0_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RJ0_Stop

Ends the count for 16-bit timer RJ0.

[Syntax]

```
void    R_TMR_RJ0_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RJ0_Set_PowerOff

Halts the clock supplied to the 16-bit timer RJ0.

Remark Calling this API function changes the 16-bit timer RJ0 to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMR_RJ0_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RJ0_Get_PulseWidth

Reads the pulse width of the 16-bit timer RJ0.

Remarks 1. This API function can only be called when the 16-bit timer RJ0 is being used for pulse width measurement mode / pulse period measurement mode.

2. If there is an overflow (2 pulses or more) during pulse-width measurement, then the pulse width will not be read correctly.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_TMR_RJ0_Get_PulseWidth ( uint32_t * const active_width );
```

[Argument(s)]

I/O	Argument	Description
O	`uint32_t * const active_width;`	Pointer to an area storing the active level width that was read from the TRJ0IO pin

[Return value]

None.

C.2.6 Timer RD

Below is a list of API functions output by the Code Generator for timer RD use.

Table C-6. API Functions: [Timer RD]

API Function Name	Function
R_TMR_RDn_Create	Performs initialization necessary to control the 16-bit timer RD*n*.
R_TMR_RDn_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer RD*n*.
r_tmr_rdn_interrupt	Performs processing in response to the timer interrupt.
R_TMR_RDn_Start	Starts the count for 16-bit timer RD*n*.
R_TMR_RDn_Stop	Ends the count for 16-bit timer RD*n*.
R_TMR_RDn_Set_PowerOff	Halts the clock supplied to the 16-bit timer RD*n*.
R_TMR_RDn_ForcedOutput_Start	Starts the pulse output forced cutoff for 16-bit timer RD*n*,
R_TMR_RDn_ForcedOutput_Stop	Ends the pulse output forced cutoff for 16-bit timer RD*n*.
R_TMR_RDn_Get_PulseWidth	Reads the pulse width of the 16-bit timer RD*n*.

R_TMR_RD*n*_Create

Performs initialization necessary to control the 16-bit timer RD*n*.

[Syntax]

```
void    R_TMR_RDn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer RD*n*.

Remark This API function is called as the R_TMR_RDn_Create callback routine.

[Syntax]

```
void    R_TMR_RDn_Create_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_tmr_rd*n*_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_tmr_rdn_interrupt ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_Start

Starts the count for 16-bit timer RD*n*.

[Syntax]

```
void    R_TMR_RDn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_Stop

Ends the count for 16-bit timer RD*n*.

[Syntax]

```
void    R_TMR_RDn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_Set_PowerOff

Halts the clock supplied to the 16-bit timer RD*n*.

Remark Calling this API function changes the 16-bit timer RD*n* to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMR_RDn_Set_PowerOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_ForcedOutput_Start

Starts the pulse output forced cutoff for 16-bit timer RD*n*.

[Syntax]

```
void    R_TMR_RDn_ForcedOutput_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_ForcedOutput_Stop

Ends the pulse output forced cutoff for 16-bit timer RD*n*.

Remark This API function can only be called when the 16-bit timer RD*n* is the count to stopped (the TSTART bit in the timer RD start register (TRDSTR) is 0).

[Syntax]

```
void    R_TMR_RDn_ForcedOutput_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_RD*n*_Get_PulseWidth

Reads the pulse width of the 16-bit timer RD*n*.

Remarks 1. This API function can only be called when the 16-bit timer RD*n* is being used for input capture function.

2. If there is an overflow (2 pulses or more) during pulse-width measurement, then the pulse width will not be read correctly.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_timer.h"
MD_STATUS   R_TMR_RDn_Get_PulseWidth ( uint32_t * const active_width, uint32_t * const
inactive_width, timer_channel_t channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint32_t * const active_width;`	Pointer to an area storing the active level width that was read
O	`uint32_t * const inactive_width;`	Pointer to an area storing the inactive level width that was read
I	`timer_channel_t channel;`	Pin to read TMCHANNELA: TRDIOA*n* pin TMCHANNELB: TRDIOB*n* pin TMCHANNELC: TRDIOC*n* pin TMCHANNELD: TRDIOD*n* pin

[Return value]

Macro	Description
MD_OK	Normal completion

C.2.7 Timer RG

Below is a list of API functions output by the Code Generator for timer RG use.

Table C-7. API Functions: [Timer RG]

API Function Name	Function
R_TMR_RG0_Create	Performs initialization necessary to control the 16-bit timer RG0.
R_TMR_RG0_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer RG0.
r_tmr_rg0_interrupt	Performs processing in response to the timer interrupt.
R_TMR_RG0_Start	Starts the count for 16-bit timer RG0.
R_TMR_RG0_Stop	Ends the count for 16-bit timer RG0.
R_TMR_RG0_Set_PowerOff	Halts the clock supplied to the 16-bit timer RG0.
R_TMR_RG0_Get_PulseWidth	Reads the pulse width of the 16-bit timer RG0.

R_TMR_RG0_Create

Performs initialization necessary to control the 16-bit timer RG0.

[Syntax]

```
void    R_TMR_RG0_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RG0_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer RG0.

Remark This API function is called as the R_TMR_RG0_Create callback routine.

[Syntax]

```
void    R_TMR_RG0_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_tmr_rg0_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_tmr_rg0_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RG0_Start

Starts the count for 16-bit timer RG0.

[Syntax]

```
void    R_TMR_RG0_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RG0_Stop

Ends the count for 16-bit timer RG0.

[Syntax]

```
void    R_TMR_RG0_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RG0_Set_PowerOff

Halts the clock supplied to the 16-bit timer RG0.

Remark Calling this API function changes the 16-bit timer RG0 to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMR_RG0_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_RG0_Get_PulseWidth

Reads the pulse width of the 16-bit timer RG0.

Remarks 1. This API function can only be called when the 16-bit timer RG0 is being used for input capture function.

2. If there is an overflow (2 pulses or more) during pulse-width measurement, then the pulse width will not be read correctly.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_timer.h"
MD_STATUS   R_TMR_RG0_Get_PulseWidth ( uint32_t * const active_width, uint32_t * const
inactive_width, timer_channel_t channel );
```

[Argument(s)]

I/O	Argument	Description
O	`uint32_t * const active_width;`	Pointer to an area storing the active level width that was read from the TRGIOA pin
O	`uint32_t * const inactive_width;`	Pointer to an area storing the inactive level width that was read from the TRGIOA pin
I	`timer_channel_t channel;`	Pin to read TMCHANNELA: TRGIOA0 pin TMCHANNELB: TRGIOB0 pin

[Return value]

Macro	Description
MD_OK	Normal completion

C.2.8 16-bit timer KB

Below is a list of API functions output by the Code Generator for 16-bit timer KB use.

Table C-8. API Functions: [16-bit Timers KB]

API Function Name	Function
R_TMR_KB_Create	Performs initialization necessary to control the 16-bit timer KB.
R_TMR_KBm_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer KB.
r_tmr_kbm_interrupt	Performs processing in response to the timer interrupt.
R_TMR_KBm_Start	Starts the count for 16-bit timer KB.
R_TMR_KBm_Stop	Ends the count for 16-bit timer KB.
R_TMR_KBm_Set_PowerOff	Halts the clock supplied to the 16-bit timer KB.
R_TMR_KBmn_ForcedOutput_Start	Enables input of the trigger signal used for the forced output stop function.
R_TMR_KBmn_ForcedOutput_Stop	Disables input of the trigger signal used for the forced output stop function.
R_TMR_KBm_BatchOverwriteRequestOn	Enables batch overwriting of the compare register.

R_TMR_KB_Create

Performs initialization necessary to control the 16-bit timers KB.

[Syntax]

```
void    R_TMR_KB_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*m*_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer KB.

Remark This API function is called as the R_TMR_KB_Create callback routine.

[Syntax]

```
void    R_TMR_KBm_Create_UserInit ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

r_tmr_kb*m*_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_tmr_kbm_interrupt ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*m*_Start

Starts the count for 16-bit timer KB.

[Syntax]

```
void    R_TMR_KBm_Start ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*m*_Stop

Ends the count for 16-bit timer KB.

[Syntax]

```
void    R_TMR_KBm_Stop ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*m*_Set_PowerOff

Halts the clock supplied to the 16-bit timer KB.

Remark Calling this API function changes the 16-bit timer KB to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMR_KBm_Set_PowerOff ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*mn*_ForcedOutput_Start

Enables input of the trigger signal used for the forced output stop function.

[Syntax]

```
void    R_TMR_KBmn_ForcedOutput_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*mn*_ForcedOutput_Stop

Disables input of the trigger signal used for the forced output stop function.

[Syntax]

```
void    R_TMR_KBmn_ForcedOutput_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_TMR_KB*m*_BatchOverwriteRequestOn

Enables batch overwriting of the compare register.

Remark The timing for batch-overwriting the content of the compare register is when a count value and a value set in the compare register are matched or an external trigger is generated after calling this API function.

[Syntax]

```
void    R_TMR_KBm_BatchOverwriteRequestOn ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

C.2.9 16-bit timer KC0

Below is a list of API functions output by the Code Generator for 16-bit timer KC0 use.

Table C-9. API Functions: [16-bit Timer KC0]

API Function Name	Function
R_TMR_KC0_Create	Performs initialization necessary to control the 16-bit timer KC0.
R_TMR_KC0_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer KC0.
r_tmr_kc0_interrupt	Performs processing in response to the timer interrupt.
R_TMR_KC0_Start	Starts the count for 16-bit timer KC0.
R_TMR_KC0_Stop	Ends the count for 16-bit timer KC0.
R_TMR_KC0_Set_PowerOff	Halts the clock supplied to the 16-bit timer KC0.

R_TMR_KC0_Create

Performs initialization necessary to control the the 16-bit timer KC0.

[Syntax]

```
void    R_TMR_KC0_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_KC0_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer KC0.

Remark This API function is called as the R_TMR_KC0_Create callback routine.

[Syntax]

```
void    R_TMR_KC0_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_tmr_kc0_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_tmr_kc0_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_KC0_Start

Starts the count for 16-bit timer KC0.

[Syntax]

```
void    R_TMR_KC0_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_KC0_Stop

Ends the count for 16-bit timer KC0.

[Syntax]

```
void    R_TMR_KC0_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMR_KC0_Set_PowerOff

Halts the clock supplied to the 16-bit timer KC0.

Remark Calling this API function changes the 16-bit timer KC0 to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMR_KC0_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.10 16-bit timer KB2

Below is a list of API functions output by the Code Generator for 16-bit timer KB2 use.

Table C-10. API Functions: [16-bit Timer KB2]

API Function Name	Function
R_KB2m_Create	Performs initialization necessary to control the 16-bit timer KB2.
R_KB2m_Create_UserInit	Performs user-defined initialization relating to the 16-bit timer KB2.
r_kb2m_interrupt	Performs processing in response to the timer interrupt INTTKB2*m*.
R_KB2m_Start	Starts the count for 16-bit timer KB2.
R_KB2m_Stop	Ends the count for 16-bit timer KB2.
R_KB2m_Set_PowerOff	Halts the clock supplied to the 16-bit timer KB2.
R_KB2m_Simultaneous_Start	Starts the simultaneous start/stop mode.
R_KB2m_Simultaneous_Stop	Ends the simultaneous start/stop mode.
R_KB2m_Synchronous_Start	Starts the timer start/clear mode.
R_KB2m_Synchronous_Stop	Ends the timer start/clear mode.
R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Start	Starts forced output stop function 1 for timer output TKBO*n*0.
R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Stop	Ends forced output stop function 1 for timer output TKBO*n*0.
R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Start	Starts forced output stop function 2 for timer output TKBO*n*1.
R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Stop	Starts forced output stop function 2 for timer output TKBO*n*1.
R_KB2m_TKBOn0_DitheringFunction_Start	Starts dithering function for timer output TKBO*n*0.
R_KB2m_TKBOn0_DitheringFunction_Stop	Ends dithering function for timer output TKBO*n*0.
R_KB2m_TKBOn1_DitheringFunction_Start	Starts dithering function for timer output TKBO*n*1.
R_KB2m_TKBOn1_DitheringFunction_Stop	Ends dithering function for timer output TKBO*n*1.
R_KB2m_TKBOn0_SmoothStartFunction_Start	Starts smooth start function for timer output TKBO*n*0.
R_KB2m_TKBOn0_SmoothStartFunction_Stop	Ends smooth start function for timer output TKBO*n*0.
R_KB2m_TKBOn1_SmoothStartFunction_Start	Starts smooth start function for timer output TKBO*n*1.
R_KB2m_TKBOn1_SmoothStartFunction_Stop	Ends smooth start function for timer output TKBO*n*1.
R_KB2m_Set_BatchOverwriteRequestOn	Enables batch overwriting of the compare register.

R_KB2*m*_Create

Performs initialization necessary to control the 16-bit timer KB2.

[Syntax]

```
void    R_KB2m_Create ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Create_UserInit

Performs user-defined initialization relating to the 16-bit timer KB2.

Remark This API function is called as the R_KB2m_Create callback routine.

[Syntax]

```
void    R_KB2m_Create_UserInit ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

r_kb2*m*_interrupt

Performs processing in response to the timer interrupt INTTKB2*m*.

Remark This API function is called as the interrupt process corresponding to the timer interrupt INTTKB2*m*.

[Syntax]

```
__interrupt static  void    r_kb2m_interrupt ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Start

Starts the count for 16-bit timer KB2.

[Syntax]

```
void    R_KB2m_Start ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Stop

Ends the count for 16-bit timer KB2.

[Syntax]

```
void    R_KB2m_Stop ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Set_PowerOff

Halts the clock supplied to the 16-bit timer KB2.

[Syntax]

```
void    R_KB2m_Set_PowerOff ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Simultaneous_Start

Starts the simultaneous start/stop mode.

[Syntax]

```
void    R_KB2m_Simultaneous_Start ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Simultaneous_Stop

Ends the simultaneous start/stop mode.

[Syntax]

```
void    R_KB2m_Simultaneous_Stop ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Synchronous_Start

Starts the timer start/clear mode.

[Syntax]

```
void    R_KB2m_Synchronous_Start ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Synchronous_Stop

Ends the timer start/clear mode.

[Syntax]

```
void    R_KB2m_Synchronous_Stop ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_Forced_Output_Stop_Function1_Start

Starts forced output stop function 1 for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_Forced_Output_Stop_Function1_Stop

Ends forced output stop function 1 for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_Forced_Output_Stop_Function1_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_Forced_Output_Stop_Function1_Start

Starts forced output stop function 2 for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_Forced_Output_Stop_Function1_Stop

Ends forced output stop function 2 for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_Forced_Output_Stop_Function1_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_DitheringFunction_Start

Starts dithering function for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_DitheringFunction_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_DitheringFunction_Stop

Ends dithering function for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_DitheringFunction_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_DitheringFunction_Start

Starts dithering function for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_DitheringFunction_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_DitheringFunction_Stop

Ends dithering function for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_DitheringFunction_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_SmoothStartFunction_Start

Starts smooth start function for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_SmoothStartFunction_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*0_SmoothStartFunction_Stop

Ends smooth start function for timer output TKBO*n*0.

[Syntax]

```
void    R_KB2m_TKBOn0_SmoothStartFunction_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_SmoothStartFunction_Start

Starts smooth start function for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_SmoothStartFunction_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_TKBO*n*1_SmoothStartFunction_Stop

Ends smooth start function for timer output TKBO*n*1.

[Syntax]

```
void    R_KB2m_TKBOn1_SmoothStartFunction_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_KB2*m*_Set_BatchOverwriteRequestOn

Enables batch overwriting of the compare register.

Remark The timing for batch-overwriting the content of the compare register is when a count value and a value set in the compare register are matched or an external trigger is generated after calling this API function.

[Syntax]

```
void    R_KB2m_Set_BatchOverwriteRequestOn ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

C.2.11 Real-time clock

Below is a list of API functions output by the Code Generator for real-time clock use.

Table C-11. API Functions: [Real-time Clock]

API Function Name	Function
R_RTC_Create	Performs initialization necessary to control the real-time clock.
R_RTC_Create_UserInit	Performs user-defined initialization relating to the real-time clock.
r_rtc_interrupt	Performs processing in response to the real-time clock interrupt INTRTC.
R_RTC_Start	Starts the count of the real-time clock (year, month, weekday, day, hour, minute, second).
R_RTC_Stop	Ends the count of the real-time clock (year, month, weekday, day, hour, minute, second).
R_RTC_Set_PowerOff	Halts the clock supplied to the real-time clock.
R_RTC_Set_HourSystem	Sets the clock type (12-hour or 24-hour clock) of the real-time clock.
R_RTC_Set_CounterValue	Sets the counter value (year, month, weekday, day, hour, minute, second) of the real-time clock.
R_RTC_Get_CounterValue	Reads the counter value (year, month, weekday, day, hour, minute, second) of the real-time clock.
R_RTC_Set_ConstPeriodInterruptOn	Sets the cycle of the interrupts INTRTC, then starts the cyclic interrupt function.
R_RTC_Set_ConstPeriodInterruptOff	Ends the cyclic interrupt function.
r_rtc_callback_constperiod	Performs processing in response to the cyclic interrupt INTRTC.
R_RTC_Set_AlarmOn	Starts the alarm interrupt function.
R_RTC_Set_AlarmOff	Ends the alarm interrupt function.
R_RTC_Set_AlarmValue	Sets the alarm conditions (weekday, hour, minute).
R_RTC_Get_AlarmValue	Reads the alarm conditions (weekday, hour, minute).
r_rtc_callback_alarm	Performs processing in response to the alarm interrupt INTRTC.
R_RTC_Set_RTC1HZOn	Enables output of the correction clock (1 Hz) to the RTC1HZ pin.
R_RTC_Set_RTC1HZOff	Disables output of the correction clock (1 Hz) to the RTC1HZ pin.

R_RTC_Create

Performs initialization necessary to control the real-time clock.

[Syntax]

```
void    R_RTC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Create_UserInit

Performs user-defined initialization relating to the real-time clock.

Remark This API function is called as the R_RTC_Create callback routine.

[Syntax]

```
void    R_RTC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_rtc_interrupt

Performs processing in response to the real-time clock interrupt INTRTC.

Remark This API function is called as the interrupt process corresponding to the real-time clock interrupt INTRTC.

[Syntax]

```
__interrupt static  void    r_rtc_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Start

Starts the count of the real-time clock (year, month, weekday, day, hour, minute, second).

[Syntax]

```
void    R_RTC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Stop

Ends the count of the real-time clock (year, month, weekday, day, hour, minute, second).

[Syntax]

```
void    R_RTC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_PowerOff

Halts the clock supplied to the real-time clock.

Remarks 1. Calling this API function changes the real-time clock to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

2. This API function stops the clock supply to the real-time clock, by operating the RTCEN bit of peripheral enable register *n*.
For this reason, this API function also stops the clock supply to other peripheral devices sharing the RTCEN bit (e.g. interval timer).

[Syntax]

```
void    R_RTC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_HourSystem

Sets the clock type (12-hour or 24-hour clock) of the real-time clock.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
MD_STATUS   R_RTC_Set_HourSystem ( rtc_hour_system_t hour_system );
```

[Argument(s)]

I/O	Argument	Description
I	`rtc_hour_system_t` *`hour_system`*`;`	Clock type HOUR12: 12-hour clock HOUR24: 24-hour clock

[Return value]

Macro	Description
MD_OK	Normal completion
MD_BUSY1	Executing count process (before change to setting)
MD_BUSY2	Stopping count process (after change to setting)
MD_ARGERROR	Invalid argument specification

Remark If MD_BUSY1 or MD_BUSY2 is returned, it may be because the counter-operation is stopped, or the counter operation start wait time is too short, so make the value of the RTC_WAITTIME macro defined in the header file "r_cg_rtc.h" larger.

R_RTC_Set_CounterValue

Sets the counter value (year, month, weekday, day, hour, minute, second) of the real-time clock.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
MD_STATUS   R_RTC_Set_CounterValue ( rtc_counter_value_t counter_write_val );
```

[Argument(s)]

I/O	Argument	Description
I	rtc_counter_value_t *counter_write_val*;	Counter value

Remark Below is an example of the structure rtc_counter_value_t (counter value) for the real-time clock.

```
typedef struct {
    uint8_t sec;    /* second */
    uint8_t min;    /* Minute */
    uint8_t hour;   /* Hour */
    uint8_t day;    /* Day */
    uint8_t week;   /* Weekday (0: Sunday, 6: Saturday) */
    uint8_t month;  /* Month */
    uint8_t year;   /* Year */
} rtc_counter_value_t;
```

[Return value]

Macro	Description
MD_OK	Normal completion
MD_BUSY1	Executing count process (before change to setting)
MD_BUSY2	Stopping count process (after change to setting)

Remark If MD_BUSY1 or MD_BUSY2 is returned, it may be because the counter-operation is stopped, or the counter operation start wait time is too short, so make the value of the RTC_WAITTIME macro defined in the header file "r_cg_rtc.h" larger.

R_RTC_Get_CounterValue

Reads the counter value (year, month, weekday, day, hour, minute, second) of the real-time clock.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
MD_STATUS   R_RTC_Get_CounterValue ( rtc_counter_value_t * const counter_read_val );
```

[Argument(s)]

I/O	Argument	Description
O	`rtc_counter_value_t * const counter_read_val;`	Pointer to structure in which to store the counter value being read

Remark See R_RTC_Set_CounterValue for details about the rtc_counter_value_t counter value.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_BUSY1	Executing count process (before reading)
MD_BUSY2	Stopping count process (after reading)

Remark If MD_BUSY1 or MD_BUSY2 is returned, it may be because the counter-operation is stopped, or the counter operation start wait time is too short, so make the value of the RTC_WAITTIME macro defined in the header file "r_cg_rtc.h" larger.

R_RTC_Set_ConstPeriodInterruptOn

Sets the cycle of the interrupts INTRTC, then starts the cyclic interrupt function.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
MD_STATUS   R_RTC_Set_ConstPeriodInterruptOn ( rtc_int_period_t period );
```

[Argument(s)]

I/O	Argument	Description
I	`rtc_int_period_t period;`	Interrupt INTRTC cycle HALFSEC: 0.5 seconds ONESEC: 1 second ONEMIN: 1 minute ONEHOUR: 1 hour ONEDAY: 1 day ONEMONTH: 1 month

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_RTC_Set_ConstPeriodInterruptOff

Ends the cyclic interrupt function.

[Syntax]

```
void    R_RTC_Set_ConstPeriodInterruptOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_rtc_callback_constperiod

Performs processing in response to the cyclic interrupt INTRTC.

Remark This API function is called as the callback routine of interrupt process r_rtc_interrupt corresponding to the cyclic interrupt INTRTC.

[Syntax]

```
static  void    r_rtc_callback_constperiod ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_AlarmOn

Starts the alarm interrupt function.

[Syntax]

```
void    R_RTC_Set_AlarmOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_AlarmOff

Ends the alarm interrupt function.

[Syntax]

```
void    R_RTC_Set_AlarmOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_AlarmValue

Sets the alarm conditions (weekday, hour, minute).

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
void    R_RTC_Set_AlarmValue ( rtc_alarm_value_t alarm_val );
```

[Argument(s)]

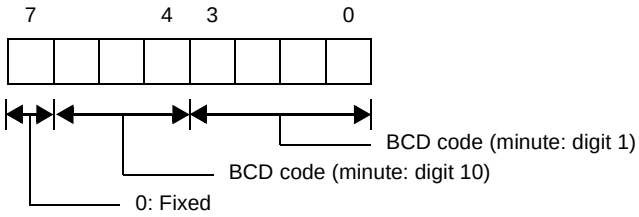
I/O	Argument	Description
I	`rtc_alarm_value_t alarm_val;`	Alarm conditions (weekday, hour, minute)

Remark Below is shown the structure rtc_alarm_value_t (alarm conditions).

```
typedef struct {
    uint8_t alarmwm;    /* Minute */
    uint8_t alarmwh;    /* Hour */
    uint8_t alarmww;    /* Weekday */
} rtc_alarm_value_t;
```

- alarmwm (Minute)

  Below are shown the meanings of each bit of the structure member alarmwm.



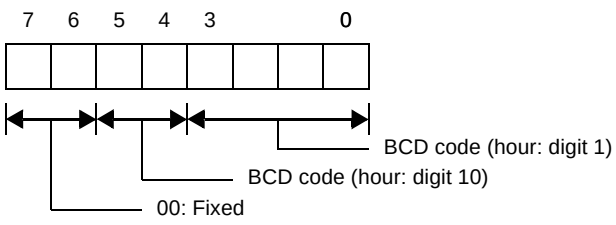
- alarmwh (Hour)

  Below are shown the meanings of each bit of the structure member alarmwh.

  If the real-time clock is set to the 12-hour clock, then bit 5 has the following meaning.

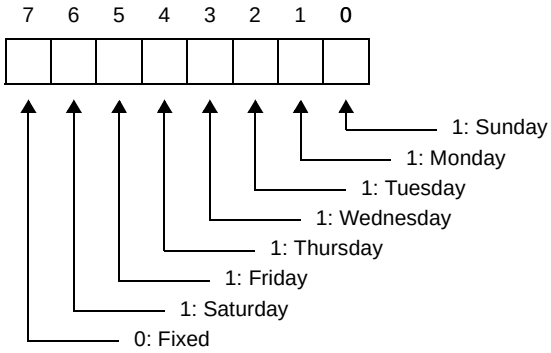
  0: AM

  1: PM



- alarmww (Weekday)

  Below are shown the meanings of each bit of the structure member alarmww.



[Return value]

None.

R_RTC_Get_AlarmValue

Reads the alarm conditions (weekday, hour, minute).

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_rtc.h"
void    R_RTC_Get_AlarmValue ( rtc_alarm_value_t * const alarm_val );
```

Remark See R_RTC_Set_AlarmValue for details about rtc_alarm_value_t (alarm conditions).

[Argument(s)]

I/O	Argument	Description
O	`rtc_alarm_value_t * const alarm_val;`	Pointer to structure in which to store the conditions being read

[Return value]

None.

r_rtc_callback_alarm

Performs processing in response to the alarm interrupt INTRTC.

Remark This API function is called as the callback routine of interrupt process r_rtc_interrupt corresponding to the alarm interrupt INTRTC.

[Syntax]

```
static  void    r_rtc_callback_alarm ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_RTC1HZOn

Enables output of the correction clock (1 Hz) to the RTC1HZ pin.

[Syntax]

```
void    R_RTC_Set_RTC1HZOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_RTC_Set_RTC1HZOff

Disables output of the correction clock (1 Hz) to the RTC1HZ pin.

[Syntax]

```
void    R_RTC_Set_RTC1HZOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.12 Subsystem clock frequency measurement circuit

Below is a list of API functions output by the Code Generator for subsystem clock frequency measurement circuit use.

Table C-12. API Functions: [Subsystem Clock Frequency Measurement Circuit]

API Function Name	Function
R_FMC_Create	Performs initialization necessary to control the subsystem clock frequency measurement circuit.
R_FMC_Create_UserInit	Performs user-defined initialization relating to the subsystem clock frequency measurement circuit.
r_fmc_interrupt	Performs processing in response to the end of frequency measurement interrupt INTFM.
R_FMC_Start	Starts measurement of the frequency that uses the subsystem clock frequency measurement circuit.
R_FMC_Stop	Ends measurement of the frequency that uses the subsystem clock frequency measurement circuit.
R_FMC_Set_PowerOff	Halts the clock supplied to the subsystem clock frequency measurement circuit.

R_FMC_Create

Performs initialization necessary to control the subsystem clock frequency measurement circuit.

[Syntax]

```
void    R_FMC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_FMC_Create_UserInit

Performs user-defined initialization relating to the subsystem clock frequency measurement circuit.

Remark This API function is called as the R_FMC_Create callback routine.

[Syntax]

```
void    R_FMC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_fmc_interrupt

Performs processing in response to the end of frequency measurement interrupt INTFM.

Remark This API function is called as the interrupt process corresponding to the end of frequency measurement interrupt INTFM.

[Syntax]

```
__interrupt static  void    r_fmc_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_FMC_Start

Starts measurement of the frequency that uses the subsystem clock frequency measurement circuit.

[Syntax]

```
void    R_FMC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_FMC_Stop

Ends measurement of the frequency that uses the subsystem clock frequency measurement circuit.

[Syntax]

```
void    R_FMC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_FMC_Set_PowerOff

Halts the clock supplied to the subsystem clock frequency measurement circuit.

Remark Calling this API function changes the subsystem clock frequency measurement circuit to reset status. For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_FMC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.13 12-bit interval timer

Below is a list of API functions output by the Code Generator for 12-bit interval timer use.

Table C-13. API Functions: [12-Bit Interval Timer]

API Function Name	Function
R_IT_Create	Performs initialization necessary to control the 12-bit interval timer.
R_IT_Create_UserInit	Performs user-defined initialization relating to the 12-bit interval timer.
r_it_interrupt	Performs processing in response to the 12-bit interval timer interrupt INTIT.
R_IT_Start	Starts the count of the 12-bit interval timer.
R_IT_Stop	Ends the count of the 12-bit interval timer.
R_IT_Set_PowerOff	Halts the clock supplied to the 12-bit interval timer.

R_IT_Create

Performs initialization necessary to control the 12-bit interval timer.

[Syntax]

```
void    R_IT_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_IT_Create_UserInit

Performs user-defined initialization relating to the 12-bit interval timer.

Remark This API function is called as the R_IT_Create callback routine.

[Syntax]

```
void    R_IT_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_it_interrupt

Performs processing in response to the 12-bit interval timer interrupt INTIT.

Remark This API function is called as the interrupt process corresponding to the 12-bit interval timer interrupt INTIT.

[Syntax]

```
__interrupt static  void    r_it_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_IT_Start

Starts the count of the 12-bit interval timer.

[Syntax]

```
void    R_IT_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_IT_Stop

Ends the count of the 12-bit interval timer.

[Syntax]

```
void    R_IT_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_IT_Set_PowerOff

Halts the clock supplied to the 12-bit interval timer.

Remarks 1. Calling this API function changes the 12-bit interval timer to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

2. This API function stops the clock supply to the 12-bit interval timer, by operating the RTCEN bit of peripheral enable register *n*.
For this reason, this API function also stops the clock supply to other peripheral devices sharing the RTCEN bit (e.g. real-timer clock).

[Syntax]

```
void    R_IT_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.14 8-bit interval timer

Below is a list of API functions output by the Code Generator for 8-bit interval timer use.

Table C-14. API Functions: [8-Bit Interval Timer]

API Function Name	Function
R_IT8bitm_Channeln_Create	Performs initialization necessary to control the 8-bit interval timer.
R_IT8bitm_Channeln_Create_UserInit	Performs user-defined initialization relating to the 8-bit interval timer.
r_it8bitm_channeln_interrupt	Performs processing in response to the 8-bit interval timer interrupt INTIT*n*0 or INTIT*n*1.
R_IT8bitm_Channeln_Start	Starts the count of the 8-bit interval timer.
R_IT8bitm_Channeln_Stop	Ends the count of the 8-bit interval timer.
R_IT8bitm_Channeln_Set_PowerOff	Halts the clock supplied to the 8-bit interval timer.

R_IT8bit*m*_Channel*n*_Create

Performs initialization necessary to control the 8-bit interval timer.

[Syntax]

```
void    R_IT8bitm_Channeln_Create ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IT8bit*m*_Channel*n*_Create_UserInit

Performs user-defined initialization relating to the 8-bit interval timer.

Remark This API function is called as the R_IT8bitm_Channeln_Create callback routine.

[Syntax]

```
void    R_IT8bitm_Channeln_Create_UserInit ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_it8bit*m*_channel*n*_interrupt

Performs processing in response to the 8-bit interval timer interrupt INTIT*n*0 or INTIT*n*1.

Remark This API function is called as the interrupt process corresponding to the 8-bit interval timer interrupt INTIT*n*0 or INTIT*n*1.

[Syntax]

```
__interrupt static  void    r_it8bitm_channeln_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_IT8bit*m*_Channel*n*_Start

Starts the count of the 8-bit interval timer.

[Syntax]

```
void    R_IT8bitm_Channeln_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IT8bit*m*_Channel*n*_Stop

Ends the count of the 8-bit interval timer.

[Syntax]

```
void    R_IT8bitm_Channeln_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IT8bit*m*_Channel*n*_Set_PowerOff

Halts the clock supplied to the 8-bit interval timer.

Remark Calling this API function changes the 8-bit interval timer to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_IT8bitm_Channeln_Set_PowerOff ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.2.15 16-bit wakeup timer

Below is a list of API functions output by the Code Generator for 16-bit wakeup timer (WUTM) use.

Table C-15. API Functions: [16-bit Wakeup Timer]

API Function Name	Function
R_WUTM_Create	Performs initialization necessary to control the 16-bit wakeup timer.
R_WUTM_Create_UserInit	Performs user-defined initialization relating to the 16-bit wakeup timer.
r_wutm_interrupt	Performs processing in response to the timer interrupt.
R_WUTM_Start	Starts the count for 16-bit wakeup timer.
R_WUTM_Stop	Ends the count for 16-bit wakeup timer.
R_WUTM_Set_PowerOff	Halts the clock supplied to the 16-bit wakeup timer.

R_WUTM_Create

Performs initialization necessary to control the 16-bit wakeup timer.

[Syntax]

```
void    R_WUTM_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WUTM_Create_UserInit

Performs user-defined initialization relating to the 16-bit wakeup timer.

Remark This API function is called as the R_WUTM_Create callback routine.

[Syntax]

```
void    R_WUTM_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_wutm_interrupt

Performs processing in response to the timer interrupt.

Remark This API function is called as the interrupt process corresponding to the timer interrupt.

[Syntax]

```
__interrupt static  void    r_wutm_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WUTM_Start

Starts the count for 16-bit wakeup timer.

[Syntax]

```
void    R_WUTM_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WUTM_Stop

Ends the count for 16-bit wakeup timer.

[Syntax]

```
void    R_WUTM_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WUTM_Set_PowerOff

Halts the clock supplied to the 16-bit wakeup timer.

Remark Calling this API function changes the 16-bit wakeup timer to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_WUTM_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.16 Clock output/buzzer output controller

Below is a list of API functions output by the Code Generator for clock output/buzzer output controller use.

Table C-16. API Functions: [Clock Output/Buzzer Output Controller]

API Function Name	Function
R_PCLBUZn_Create	Performs initialization necessary to control the clock/buzzer output controller.
R_PCLBUZn_Create_UserInit	Performs user-defined initialization relating to the clock/buzzer output controller.
R_PCLBUZn_Start	Starts clock/buzzer output.
R_PCLBUZn_Stop	Ends clock/buzzer output.
R_PCLBUZ_Set_PowerOff	Halts the clock supplied to the clock/buzzer output controller.

R_PCLBUZ*n*_Create

Performs initialization necessary to control the clock/buzzer output controller.

[Syntax]

```
void    R_PCLBUZn_Create ( void );
```

Remark *n* is the output pin.

[Argument(s)]

None.

[Return value]

None.

R_PCLBUZ*n*_Create_UserInit

Performs user-defined initialization relating to the clock/buzzer output controller.

Remark This API function is called as the R_PCLBUZn_Create callback routine.

[Syntax]

```
void    R_PCLBUZn_Create_UserInit ( void );
```

Remark *n* is the output pin.

[Argument(s)]

None.

[Return value]

None.

R_PCLBUZ*n*_Start

Starts clock/buzzer output.

[Syntax]

```
void    R_PCLBUZn_Start ( void );
```

Remark *n* is the output pin.

[Argument(s)]

None.

[Return value]

None.

R_PCLBUZ*n*_Stop

Ends clock/buzzer output.

[Syntax]

```
void    R_PCLBUZn_Stop ( void );
```

Remark *n* is the output pin.

[Argument(s)]

None.

[Return value]

None.

R_PCLBUZ_Set_PowerOff

Halts the clock supplied to the clock/buzzer output controller.

Remarks 1. Calling this API function changes the clock/buzzer output controller to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

2. This API function stops the clock supply to the clock/buzzer output controller, by operating the RTCEN bit of peripheral enable register *n*.
For this reason, this API function also stops the clock supply to other peripheral devices sharing the RTCEN bit (e.g. real-time clock).

[Syntax]

```
void    R_PCLBUZ_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.17 Watchdog timer

Below is a list of API functions output by the Code Generator for watchdog timer use.

Table C-17. API Functions: [Watchdog Timer]

API Function Name	Function
R_WDT_Create	Performs initialization necessary to control the watchdog timer.
R_WDT_Create_UserInit	Performs user-defined initialization relating to the watchdog timer.
r_wdt_interrupt	Performs processing in response to the interval interrupt INTWDTI.
R_WDT_Restart	Clears the watchdog timer counter and resumes counting.

R_WDT_Create

Performs initialization necessary to control the watchdog timer.

[Syntax]

```
void    R_WDT_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WDT_Create_UserInit

Performs user-defined initialization relating to the watchdog timer.

Remark This API function is called as the R_WDT_Create callback routine.

[Syntax]

```
void    R_WDT_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_wdt_interrupt

Performs processing in response to the interval interrupt INTWDTI.

Remark This API function is called as the interrupt process corresponding to the interval interrupt INTWDTI.

[Syntax]

```
__interrupt static  void    r_wdt_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_WDT_Restart

Clears the watchdog timer counter and resumes counting.

[Syntax]

```
void    R_WDT_Restart ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.18 A/D converter

Below is a list of API functions output by the Code Generator for A/D converter use.

Table C-18. API Functions: [A/D Converter]

API Function Name	Function
R_ADC_Create	Performs initialization necessary to control the A/D converter.
R_ADC_Create_UserInit	Performs user-defined initialization relating to the A/D converter.
r_adc_interrupt	Performs processing in response to the A/D conversion end interrupt INTAD.
R_ADC_Set_OperationOn	Enables operation of voltage converter.
R_ADC_Set_OperationOff	Disables operation of voltage converter.
R_ADC_Start	Starts A/D conversion.
R_ADC_Stop	Ends A/D conversion.
R_ADC_Set_PowerOff	Halts the clock supplied to the A/D converter.
R_ADC_Set_ADChannel	Configures the analog voltage input pin for A/D conversion.
R_ADC_Set_SnoozeOn	Enables the switch from STOP mode to SNOOZE mode.
R_ADC_Set_SnoozeOff	Disables the switch from STOP mode to SNOOZE mode.
R_ADC_Set_TestChannel	Sets the operation mode of A/D converter.
R_ADC_Get_Result	Reads the results of A/D conversion (10 bits).
R_ADC_Get_Result_8bit	Reads the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution).

R_ADC_Create

Performs initialization necessary to control the A/D converter.

[Syntax]

```
void    R_ADC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Create_UserInit

Performs user-defined initialization relating to the A/D converter.

Remark This API function is called as the R_ADC_Create callback routine.

[Syntax]

```
void    R_ADC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_adc_interrupt

Performs processing in response to the A/D conversion end interrupt INTAD.

Remark This API function is called as the interrupt process corresponding to the A/D conversion end interrupt INTAD.

[Syntax]

```
__interrupt static  void    r_adc_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_OperationOn

Enables operation of voltage converter.

Remarks 1. About 1 microsecond of stabilization time is required when changing the voltage converter from operation stopped to operation enabled status.
Consequently, about 1 micro second must be left free between the call to this API function and the call to R_ADC_Start.

2. On the [A/D Converter], in the [Comparator operation setting] area, if "Operation" is selected, then the voltage converter will be switched to "always on".
There is thus no need to call this API function in this case.

[Syntax]

```
void    R_ADC_Set_OperationOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_OperationOff

Disables operation of voltage converter.

[Syntax]

```
void    R_ADC_Set_OperationOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Start

Starts A/D conversion.

Remark About 1 micro second of stabilization time is required when changing the voltage converter from operation stopped to operation enabled status.
Consequently, about 1 micro second must be left free between the call to R_ADC_Set_OperationOn and the call to this API function.

[Syntax]

```
void    R_ADC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Stop

Ends A/D conversion.

Remark The voltage converter continues to operate after the process of this API function completes. Consequently, to stop the operation of the voltage converter, you must call R_ADC_Set_OperationOff after the process of this API function completes.

[Syntax]

```
void    R_ADC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_PowerOff

Halts the clock supplied to the A/D converter.

Remark Calling this API function changes the A/D converter to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_ADC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_ADChannel

Configures the analog voltage input pin for A/D conversion.

Remark The value specified in argument *channel* is set to analog input channel specification register (ADS).

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_adc.h"
MD_STATUS   R_ADC_Set_ADChannel ( ad_channel_t channel );
```

[Argument(s)]

I/O	Argument	Description
I	`ad_channel_t channel;`	Analog voltage input pin ADCHANNEL*n*: Input pin

Remark See the header file r_cg_adc.h for details about the analog voltage input pin ADCHANNEL*n*.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_ADC_Set_SnoozeOn

Enables the switch from STOP mode to SNOOZE mode.

[Syntax]

```
void    R_ADC_Set_SnoozeOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_SnoozeOff

Disables the switch from STOP mode to SNOOZE mode.

[Syntax]

```
void    R_ADC_Set_SnoozeOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ADC_Set_TestChannel

Sets the operation mode of A/D converter.

[Syntax]

```
#include    "r_cg_macrodriver.h"
#include    "r_cg_adc.h"
MD_STATUS   R_ADC_Set_TestChannel ( test_channel_t channel );
```

[Argument(s)]

I/O	Argument	Description
I	`test_channel_t channel;`	Operation mode of A/D converter ADNORMALINPUT: Normal mode (Normal A/D conversion) ADAVREFM: Test mode (AVREFM input) ADAVREFP: Test mode (AVREFP input)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_ADC_Get_Result

Reads the results of A/D conversion (10 bits).

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_ADC_Get_Result ( uint16_t * const buffer );
```

[Argument(s)]

I/O	Argument	Description
O	`uint16_t * const buffer;`	Pointer to area in which to store read results of A/D conversion

[Return value]

None.

R_ADC_Get_Result_8bit

Reads the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution).

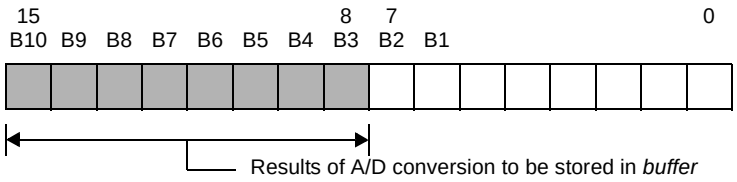
[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_ADC_Get_Result_8bit ( uint8_t * const buffer );
```

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const buffer;`	Pointer to area in which to store the results of A/D conversion

Remark Below is an example of the results of A/D conversion to be stored in *buffer*.



[Return value]

None.

C.2.19 Temperature sensor

Below is a list of API functions output by the Code Generator for temperature sensor use.

Table C-19. API Functions: [Temperature Sensor]

API Function Name	Function
R_TMPS_Create	Performs initialization necessary to control the temperature sensor.
R_TMPS_Create_UserInit	Performs user-defined initialization relating to the temperature sensor.
R_TMPS_Start	Starts measurement of the temperature that uses the temperature sensor.
R_TMPS_Stop	Ends measurement of the temperature that uses the temperature sensor.
R_TMPS_Set_PowerOff	Halts the clock supplied to the temperature sensor.

R_TMPS_Create

Performs initialization necessary to control the temperature sensor.

[Syntax]

```
void    R_TMPS_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMPS_Create_UserInit

Performs user-defined initialization relating to the temperature sensor.

Remark This API function is called as the R_TMPS_Create callback routine.

[Syntax]

```
void    R_TMPS_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMPS_Start

Starts measurement of the temperature that uses the temperature sensor.

[Syntax]

```
void    R_TMPS_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMPS_Stop

Ends measurement of the temperature that uses the temperature sensor.

[Syntax]

```
void    R_TMPS_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_TMPS_Set_PowerOff

Halts the clock supplied to the temperature sensor.

Remark Calling this API function changes the temperature sensor to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_TMPS_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.20 24-bit DS A/D converter

Below is a list of API functions output by the Code Generator for 24-bit ΔΣ A/D converter use.

Table C-20. API Functions: [24-bit ΔΣ A/D Converter]

API Function Name	Function
R_DSADC_Create	Performs initialization necessary to control the 24-bit ΔΣ A/D converter.
R_DSADC_Create_UserInit	Performs user-defined initialization relating to the 24-bit ΔΣ A/D converter.
r_dsadc_interrupt	Performs processing in response to the ΔΣ A/D conversion end interrupt INTDSAD.
R_DSADC_Set_OperationOn	Enables operation of 24-bit ΔΣ A/D converter.
R_DSADC_Set_OperationOff	Disables operation of 24-bit ΔΣ A/D converter.
R_DSADC_Start	Starts A/D conversion.
R_DSADC_Stop	Ends A/D conversion.
R_DSADC_Set_PowerOff	Performs electric charge reset for the 24-bit ΔΣ A/D converter.
R_DSADC_Channeln_Get_Result	Reads the results of A/D conversion (24 bits).
R_DSADC_Channeln_Get_Result_16bit	Reads the results of A/D conversion (16 bits; most significant 16 bits of 24-bit resolution).

R_DSADC_Create

Performs initialization necessary to control the 24-bit ΔΣ A/D converter.

[Syntax]

```
void    R_DSADC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Create_UserInit

Performs user-defined initialization relating to the 24-bit ΔΣ A/D converter.

Remark This API function is called as the R_DSADC_Create callback routine.

[Syntax]

```
void    R_DSADC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_dsadc_interrupt

Performs processing in response to the ΔΣ A/D conversion end interrupt INTDSAD.

Remark This API function is called as the interrupt process corresponding to the ΔΣ A/D conversion end interrupt INTDSAD.

[Syntax]

```
__interrupt static  void    r_dsadc_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Set_OperationOn

Enables operation of 24-bit ΔΣ A/D converter.

[Syntax]

```
void    R_DSADC_Set_OperationOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Set_OperationOff

Disables operation of 24-bit ΔΣ A/D converter.

[Syntax]

```
void    R_DSADC_Set_OperationOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Start

Starts A/D conversion.

[Syntax]

```
void    R_DSADC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Stop

Ends A/D conversion.

[Syntax]

```
void    R_DSADC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Set_PowerOff

Performs electric charge reset for the 24-bit ΔΣ A/D converter.

Remark About 1.4 microseconds of stabilization time is required when electric charge reset is performed for the 24-bit ΔΣ A/D converter.

[Syntax]

```
void    R_DSADC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DSADC_Channel*n*_Get_Result

Reads the results of A/D conversion (24 bits).

Remark The result of A/D conversion (24 bits) by this API function must be read within the maximum pending time of the ΔΣ A/D conversion result register n after ΔΣ A/D conversion end interrupt INTDSAD is generated.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_DSADC_Channeln_Get_Result ( uint32_t * const buffer );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint32_t * const buffer;`	Pointer to area in which to store read results of A/D conversion

[Return value]

None.

R_DSADC_Channel*n*_Get_Result_16bit

Reads the results of A/D conversion (16 bits; most significant 16 bits of 24-bit resolution).

Remark The result of A/D conversion by this API function must be read within the maximum pending time of the ΔΣ A/D conversion result register n after ΔΣ A/D conversion end interrupt INTDSAD is generated.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_DSADC_Channeln_Get_Result_16bit ( uint16_t * const buffer );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint16_t * const buffer;`	Pointer to area in which to store the results of A/D conversion

[Return value]

None.

C.2.21 D/A converter

Below is a list of API functions output by the Code Generator for D/A converter use.

Table C-21. API Functions: [D/A Converter]

API Function Name	Function
R_DAC_Create	Performs initialization necessary to control the D/A converter.
R_DAC_Create_UserInit	Performs user-defined initialization relating to the D/A converter.
R_DACn_Start	Starts D/A conversion.
R_DACn_Stop	Ends D/A conversion.
R_DAC_Set_PowerOff	Halts the clock supplied to the D/A converter.
R_DACn_Set_ConversionValue	Sets the analog voltage output to the ANO*n* pin.

R_DAC_Create

Performs initialization necessary to control the D/A converter.

[Syntax]

```
void    R_DAC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DAC_Create_UserInit

Performs user-defined initialization relating to the D/A converter.

Remark This API function is called as the R_DAC_Create callback routine.

[Syntax]

```
void    R_DAC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DAC*n*_Start

Starts D/A conversion.

[Syntax]

```
void    R_DACn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DAC*n*_Stop

Ends D/A conversion.

[Syntax]

```
void    R_DACn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DAC_Set_PowerOff

Halts the clock supplied to the D/A converter.

Remark Calling this API function changes the D/A converter to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_DAC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DAC*n*_Set_ConversionValue

Sets the analog voltage output to the ANO*n* pin.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_DACn_Set_ConversionValue ( uint8_t reg_value );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t reg_value;`	D/A conversion value (0x0 to 0xFF)

[Return value]

None.

C.2.22 Programmable gain amplifier

Below is a list of API functions output by the Code Generator for programmable gain amplifier use.

Table C-22. API Functions: [Programmable Gain Amplifier]

API Function Name	Function
R_PGA_Create	Performs initialization necessary to control the programmable gain amplifier.
R_PGA_Create_UserInit	Performs user-defined initialization relating to the programmable gain amplifier.
R_PGA_Start	Starts the operation of programmable gain amplifier.
R_PGA_Stop	Ends the operation of programmable gain amplifier.

R_PGA_Create

Performs initialization necessary to control the programmable gain amplifier.

[Syntax]

```
void    R_PGA_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_PGA_Create_UserInit

Performs user-defined initialization relating to the programmable gain amplifier.

Remark This API function is called as the R_PGA_Create callback routine.

[Syntax]

```
void    R_PGA_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_PGA_Start

Starts the operation of programmable gain amplifier.

[Syntax]

```
void    R_PGA_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_PGA_Stop

Ends the operation of programmable gain amplifier.

[Syntax]

```
void    R_PGA_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.23 Comparator

Below is a list of API functions output by the Code Generator for comparator use.

Table C-23. API Functions: [Comparator]

API Function Name	Function
R_COMP_Create	Performs initialization necessary to control the comparator.
R_COMP_Create_UserInit	Performs user-defined initialization relating to the comparator.
r_compn_interrupt	Performs processing in response to the comparator interrupt INTCMP*n*.
R_COMPn_Start	Begins comparison of reference input voltage and analog input voltage.
R_COMPn_Stop	Stops comparison of reference input voltage and analog input voltage.
R_COMP_Set_PowerOff	Halts the clock supplied to the comparator.

R_COMP_Create

Performs initialization necessary to control the comparator.

[Syntax]

```
void    R_COMP_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_COMP_Create_UserInit

Performs user-defined initialization relating to the comparator.

Remark This API function is called as the R_COMP_Create callback routine.

[Syntax]

```
void    R_COMP_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_comp*n*_interrupt

Performs processing in response to the comparator interrupt INTCMP*n*.

Remark This API function is called as the interrupt process corresponding to the comparator interrupt INTCMP*n*.

[Syntax]

```
__interrupt static  void    r_compn_interrupt ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_COMP*n*_Start

Begins comparison of reference input voltage and analog input voltage.

[Syntax]

```
void    R_COMPn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_COMP*n*_Stop

Stops comparison of reference input voltage and analog input voltage.

[Syntax]

```
void    R_COMPn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_COMP_Set_PowerOff

Halts the clock supplied to the comparator.

Remark Calling this API function changes the comparator to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_COMP_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.24 Serial array unit

Below is a list of API functions output by the Code Generator for serial array unit use.

Table C-24. API Functions: [Serial Array Unit]

API Function Name	Function
R_SAUm_Create	Performs initialization necessary to control the serial array unit.
R_SAUm_Create_UserInit	Performs user-defined initialization related to the serial array unit.
R_SAUm_Set_PowerOff	Halts the clock supplied to the serial array unit.
R_SAUm_Set_SnoozeOn	Enables the switch from STOP mode to SNOOZE mode.
R_SAUm_Set_SnoozeOff	Disables the switch from STOP mode to SNOOZE mode.
R_UARTn_Create	Performs initialization necessary to perform the UART communication.
r_uartn_interrupt_send	Performs processing in response to the UART transmission end interrupt INTST*n*.
r_uartn_interrupt_receive	Performs processing in response to the UART reception end interrupt INTSR*n*.
r_uartn_interrupt_error	Performs processing in response to the reception error interrupt INTSRE*n*.
R_UARTn_Start	Sets UART communication to standby mode.
R_UARTn_Stop	Ends UART communication.
R_UARTn_Send	Starts UART data transmission.
R_UARTn_Receive	Starts UART data reception.
r_uartn_callback_sendend	Performs processing in response to the UART transmission end interrupt INTST*n*.
r_uartn_callback_receiveend	Performs processing in response to the UART reception end interrupt INTSR*n*.
r_uartn_callback_error	Performs processing in response to the UART reception error interrupt INTSRE*n*.
r_uartn_callback_softwareoverrun	Performs processing in response to detection of overrun error.
R_CSImn_Create	Performs initialization necessary to perform the 3-wire serial I/O communication.
r_csimn_interrupt	Performs processing in response to the CSI communication end interrupt INTCSI*mn*.
R_CSImn_Start	Sets 3-wire serial I/O communication to standby mode.
R_CSImn_Stop	Ends 3-wire serial I/O communication.
R_CSImn_Send	Starts CSI data transmission.
R_CSImn_Receive	Starts CSI data reception.
R_CSImn_Send_Receive	Starts CSI data transmission/reception.
r_csimn_callback_sendend	Performs processing in response to the CSI transmission end interrupt INTCSI*mn*.
r_csimn_callback_receiveend	Performs processing in response to the CSI reception end interrupt INTCSI*mn*.
r_csimn_callback_error	Performs processing in response to the CSI reception error interrupt INTSRE*n*.
R_IICmn_Create	Performs initialization necessary to perform the simplified IIC communication.
r_iicmn_interrupt	Performs processing in response to the simple IIC communication end interrupt INTIIC*mn*.

API Function Name	Function
R_IICmn_StartCondition	Generates start conditions.
R_IICmn_StopCondition	Generates stop conditions.
R_IICmn_Stop	Ends simplified IIC communication.
R_IICmn_Master_Send	Starts simple IIC master transmission.
R_IICmn_Master_Receive	Starts simple IIC master reception.
r_iicmn_callback_master_sendend	Performs processing in response to the simple IIC*mn* master transmission end interrupt INTIIC*mn*.
r_iicmn_callback_master_receiveend	Performs processing in response to the simple IIC*mn* master reception end interrupt INTIIC*mn*.
r_iicmn_callback_master_error	Performs processing in response to detection of parity error (ACK error).

R_SAU*m*_Create

Performs initialization necessary to control the serial array unit.

[Syntax]

```
void    R_SAUm_Create ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_SAU*m*_Create_UserInit

Performs user-defined initialization related to the serial array unit.

Remark This API function is called as the R_SAUm_Create callback routine.

[Syntax]

```
void    R_SAUm_Create_UserInit ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_SAU*m*_Set_PowerOff

Halts the clock supplied to the serial array unit.

Remark Calling this API function changes the serial array unit to reset status.
For this reason, writes to the control registers (e.g. serial clock select register *n*: SPS*n*) after this API function is called are ignored.

[Syntax]

```
void    R_SAUm_Set_PowerOff ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_SAU*m*_Set_SnoozeOn

Enables the switch from STOP mode to SNOOZE mode.

[Syntax]

```
void    R_SAUm_Set_SnoozeOn ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_SAU*m*_Set_SnoozeOff

Disables the switch from STOP mode to SNOOZE mode.

[Syntax]

```
void    R_SAUm_Set_SnoozeOff ( void );
```

Remark *m* is the unit number.

[Argument(s)]

None.

[Return value]

None.

R_UART*n*_Create

Performs initialization necessary to perform the UART communication.

Remark This API function is used as an internal function of R_SAUm_Create.
For this reason, there is normally no need to call it from a user program.

[Syntax]

```
void    R_UARTn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uart*n*_interrupt_send

Performs processing in response to the UART transmission end interrupt INTST*n*.

Remark This API function is called as the interrupt process corresponding to the UART transmission end interrupt INTST*n*.

[Syntax]

```
__interrupt static  void    r_uartn_interrupt_send ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uart*n*_interrupt_receive

Performs processing in response to the UART reception end interrupt INTSR*n*.

Remark This API function is called as the interrupt process corresponding to the UART reception end interrupt INTSR*n*.

[Syntax]

```
__interrupt static  void    r_uartn_interrupt_receive ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uart*n*_interrupt_error

Performs processing in response to the reception error interrupt INTSRE*n*.

Remark This API function is called as the interrupt process corresponding to the reception error interrupt INTSRE*n*.

[Syntax]

```
__interrupt static  void    r_uartn_interrupt_error ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UART*n*_Start

Sets UART communication to standby mode.

[Syntax]

```
void    R_UARTn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UART*n*_Stop

Ends UART communication.

[Syntax]

```
void    R_UARTn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UART*n*_Send

Starts UART data transmission.

Remarks 1. This API function repeats the byte-level UART transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

2. When performing a UART transmission, R_UARTn_Start must be called before this API function is called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_UARTn_Send ( uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_UART*n*_Receive

Starts UART data reception.

Remarks 1. This API function performs byte-level UART reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

2. Actual UART reception starts after this API function is called, and R_UARTn_Start is then called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_UARTn_Receive ( uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

r_uart*n*_callback_sendend

Performs processing in response to the UART transmission end interrupt INTST*n*.

Remark This API function is called as the callback routine of interrupt process r_uartn_interrupt_send corresponding to the UART transmission end interrupt INTST*n* (performed when number of transmission data specified by R_UARTn_Send argument *tx_num* has been completed).

[Syntax]

```
static  void    r_uartn_callback_sendend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uart*n*_callback_receiveend

Performs processing in response to the UART reception end interrupt INTSR*n*.

Remark This API function is called as the callback routine of interrupt process r_uartn_interrupt_receive corresponding to the UART reception end interrupt INTSR*n* (performed when number of received data specified by R_UARTn_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_uartn_callback_receiveend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uart*n*_callback_error

Performs processing in response to the UART reception error interrupt INTSRE*n*.

Remark This API function is called as the callback routine of interrupt process r_uartn_interrupt_error corresponding to the UART reception error interrupt INTSRE*n*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_uartn_callback_error ( uint8_t err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t err_type;`	Trigger for UART reception error interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Parity error 000001*xx*B: Framing error

[Return value]

None.

r_uart*n*_callback_softwareoverrun

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process r_uartn_interrupt_receive corresponding to the UART reception end interrupt INTSR*n* (process performed when the amount of data received is greater than the argument *rx_num* specified for R_UARTn_Receive).

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_uartn_callback_softwareoverrun ( uint16_t rx_data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint16_t  rx_data;`	Receive data (greater than the argument *rx_num* specified for R_UARTn_Receive)

[Return value]

None.

R_CSI*mn*_Create

Performs initialization necessary to perform the 3-wire serial I/O communication.

Remark This API function is used as an internal function of R_SAUm_Create.
For this reason, there is normally no need to call it from a user program.

[Syntax]

```
void    R_CSImn_Create ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_csi*mn*_interrupt

Performs processing in response to the CSI communication end interrupt INTCSI*mn*.

Remark This API function is called as the interrupt process corresponding to the CSI communication end interrupt INTCSI*mn*.

[Syntax]

```
__interrupt static  void    r_csimn_interrupt ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_CSI*mn*_Start

Sets 3-wire serial I/O communication to standby mode.

[Syntax]

```
void    R_CSImn_Start ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_CSI*mn*_Stop

Ends 3-wire serial I/O communication.

[Syntax]

```
void    R_CSImn_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_CSI*mn*_Send

Starts CSI data transmission.

Remarks 1. This API function repeats the byte-level CSI transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

2. When performing a CSI transmission, R_CSImn_Start must be called before this API function is called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_CSImn_Send ( uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_CSI*mn*_Receive

Starts CSI data reception.

Remarks 1. This API function performs byte-level CSI reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

2. When performing a CSI reception, R_CSImn_Start must be called before this API function is called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_CSImn_Receive ( uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_CSI*mn*_Send_Receive

Starts CSI data transmission/reception.

Remarks 1. This API function repeats the byte-level CSI transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

2. This API function performs byte-level CSI reception the number of times specified by the argument *tx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

3. When performing a CSI reception, R_CSImn_Start must be called before this API function is called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_CSImn_Send_Receive ( uint8_t * const tx_buf, uint16_t tx_num, uint8_t * const
rx_buf );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send/receive
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

r_csi*mn*_callback_sendend

Performs processing in response to the CSI transmission end interrupt INTCSI*mn*.

Remark This API function is called as the callback routine of interrupt process r_csimn_interrupt corresponding to the CSI transmission end interrupt INTCSI*mn* (performed when number of transmission data specified by R_CSImn_Send or R_CSImn_Send_Receive argument *tx_num* has been completed).

[Syntax]

```
static  void    r_csimn_callback_sendend ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_csi*mn*_callback_receiveend

Performs processing in response to the CSI reception end interrupt INTCSI*mn*.

Remark This API function is called as the callback routine of interrupt process r_csimn_interrupt corresponding to the CSI reception end interrupt INTCSI*mn* (performed when number of received data specified by R_CSImn_Receive or R_CSImn_Send_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_csimn_callback_receiveend ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_csi*mn*_callback_error

Performs processing in response to the CSI reception error interrupt INTSRE*n*.

Remark This API function is called as the callback routine of interrupt process r_uartn_interrupt_error corresponding to the CSI reception error interrupt INTSRE*n*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_csimn_callback_error ( uint8_t err_type );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t err_type;`	Trigger for CSI reception error interrupt 00000*xx*1B: Overrun error

[Return value]

None.

R_IIC*mn*_Create

Performs initialization necessary to perform the simplified IIC communication.

Remark This API function is used as an internal function of R_SAUm_Create.
For this reason, there is normally no need to call it from a user program.

[Syntax]

```
void    R_IICmn_Create ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iic*mn*_interrupt

Performs processing in response to the simple IIC communication end interrupt INTIIC*mn*.

Remark This API function is called as the interrupt process corresponding to the simple IIC communication end interrupt INTIIC*mn*.

[Syntax]

```
__interrupt static  void    r_iicmn_interrupt ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IIC*mn*_StartCondition

Generates start conditions.

Remark This API function is used as an internal function of R_IICmn_Master_Send and R_IICmn_Master_Receive. For this reason, there is normally no need to call it from a user program.

[Syntax]

```
void    R_IICmn_StartCondition ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IIC*mn*_StopCondition

Generates stop conditions.

[Syntax]

```
void    R_IIC mn _StopCondition ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IIC*mn*_Stop

Ends simple IIC communication.

[Syntax]

```
void    R_IICmn_Stop ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IIC*mn*_Master_Send

Starts simple IIC master transmission.

Remark This API function repeats the byte-level simple IIC master transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

[Syntax]

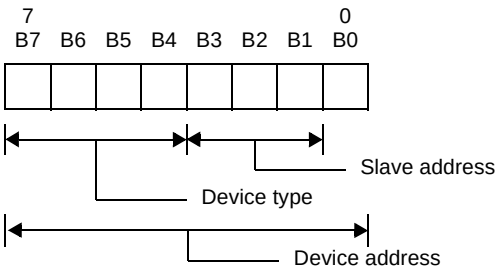
```
#include    "r_cg_macrodriver.h"
void    R_IICmn_Master_Send ( uint8_t adr, uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t adr;`	Device address
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

Remark Below is shown the format for specifying device address *adr*.



[Return value]

None.

R_IIC*mn*_Master_Receive

Starts simple IIC master reception.

Remark This API function performs byte-level simple IIC master reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

[Syntax]

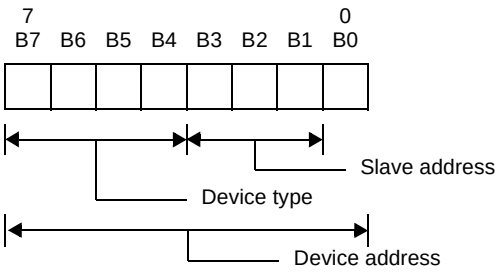
```
#include    "r_cg_macrodriver.h"
void    R_IICmn_Master_Receive ( uint8_t adr, uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t adr;`	Device address
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

Remark Below is shown the format for specifying device address *adr*.



[Return value]

None.

r_iic*mn*_callback_master_sendend

Performs processing in response to the simple IIC*mn* master transmission end interrupt INTIIC*mn*.

Remark This API function is called as the callback routine of interrupt process r_iicmn_interrupt corresponding to the simple IIC*mn* master transmission end interrupt INTIIC*mn* (performed when number of transmission data specified by R_IICmn_Master_Send argument *tx_num* has been completed).

[Syntax]

```
static  void    r_iicmn_callback_master_sendend ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iic*mn*_callback_master_receiveend

Performs processing in response to the simple IIC*mn* master reception end interrupt INTIIC*mn*.

Remark This API function is called as the callback routine of interrupt process r_iicmn_interrupt corresponding to the simple IIC*mn* master reception end interrupt INTIIC*mn* (performed when number of received data specified by R_IICmn_Master_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_iicmn_callback_master_receiveend ( void );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iic*mn*_callback_master_error

Performs processing in response to detection of parity error (ACK error).

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_iicmn_callback_master_error ( MD_STATUS flag );
```

Remark *m* is the unit number, and *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`MD_STATUS flag;`	Cause of communication error MD_NACK: Acknowledge not detected

[Return value]

None.

C.2.25 Serial array unit 4 (DALI/UART4)

Below is a list of API functions output by the Code Generator for serial array unit 4 (DALI/UART4) use.

Table C-25. API Functions: [Serial Array Unit 4]

API Function Name	Function
R_DALIn_Create	Performs initialization necessary to control the serial array unit 4 (DALI/UART4).
r_dalin_interrupt_send	Performs processing in response to the DALI transmission end interrupt INTSTDL*n*.
r_dalin_interrupt_receive	Performs processing in response to the DALI reception end interrupt INTSRDL*n*.
r_dalin_interrupt_error	Performs processing in response to the DALI reception error interrupt INTSREDL*n*.
R_DALIn_Start	Sets DALI communication to standby mode.
R_DALIn_Stop	Ends DALI communication.
R_DALIn_Send	Starts DALI data transmission.
R_DALIn_Receive	Starts DALI data reception.
r_dalin_callback_sendend	Performs processing in response to the DALI transmission end interrupt INTSTDL*n*.
r_dalin_callback_receiveend	Performs processing in response to the DALI reception end interrupt INTSRDL*n*.
r_dalin_callback_error	Performs processing in response to the DALI reception error interrupt INTSREDL*n*.
r_dalin_callback_softwareoverrun	Performs processing in response to detection of overrun error.

R_DALI*n*_Create

Performs initialization necessary to control the serial array unit 4 (DALI/UART4).

[Syntax]

```
void    R_DALIn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_dali*n*_interrupt_send

Performs processing in response to the DALI transmission end interrupt INTSTDL*n*.

Remark This API function is called as the interrupt process corresponding to the DALI transmission end interrupt INTSTDL*n*.

[Syntax]

```
__interrupt static  void    r_dalin_interrupt_send ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_dali*n*_interrupt_receive

Performs processing in response to the DALI reception end interrupt INTSRDL*n*.

Remark This API function is called as the interrupt process corresponding to the DALI reception end interrupt INTSRDL*n*.

[Syntax]

```
__interrupt static  void    r_dalin_interrupt_receive ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_dali*n*_interrupt_error

Performs processing in response to the DALI reception error interrupt INTSREDL*n*.

Remark This API function is called as the interrupt process corresponding to the DALI reception error interrupt INTSREDL*n*.

[Syntax]

```
__interrupt static  void    r_dalin_interrupt_error ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DALI*n*_Start

Sets DALI communication to standby mode.

[Syntax]

```
void    R_DALIn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DALI*n*_Stop

Ends DALI communication.

[Syntax]

```
void    R_DALIn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DALI*n*_Send

Starts DALI data transmission.

Remarks 1. This API function repeats the byte-level DALI transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

2. When performing a DALI transmission, R_DALIn_Start must be called before this API function is called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_DALIn_Send ( uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_DALI*n*_Receive

Starts DALI data reception.

Remarks 1. This API function performs byte-level DALI reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

2. Actual DALI reception starts after this API function is called, and R_DALIn_Start is then called.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_DALIn_Receive ( uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

r_dali*n*_callback_sendend

Performs processing in response to the DALI transmission end interrupt INTSTDL*n*.

Remark This API function is called as the callback routine of interrupt process r_dalin_interrupt_send corresponding to the DALI transmission end interrupt INTSTDL*n* (performed when number of transmission data specified by R_DALIn_Send argument *tx_num* has been completed).

[Syntax]

```
static  void    r_dalin_callback_sendend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_dali*n*_callback_receiveend

Performs processing in response to the DALI reception end interrupt INTSRDL*n*.

Remark This API function is called as the callback routine of interrupt process r_dalin_interrupt_receive corresponding to the DALI reception end interrupt INTSRDL*n* (performed when number of received data specified by R_DALIn_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_dalin_callback_receiveend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_dali*n*_callback_error

Performs processing in response to the DALI reception error interrupt INTSREDL*n*.

Remark This API function is called as the callback routine of interrupt process r_dalin_interrupt_error corresponding to the DALI reception error interrupt INTSREDL*n*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_dalin_callback_error ( uint8_t err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t err_type;`	Trigger for DALI reception error interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Parity error 000001*xx*B: Framing error

[Return value]

None.

r_dali*n*_callback_softwareoverrun

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process r_dalin_interrupt_receive corresponding to the DALI reception end interrupt INTSRDL*n* (process performed when the amount of data received is greater than the argument *rx_num* specified for R_DALIn_Receive).

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_dalin_callback_softwareoverrun ( uint16_t rx_data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint16_t  rx_data;`	Receive data (greater than the argument *rx_num* specified for R_DALIn_Receive)

[Return value]

None.

C.2.26 Asynchronous serial interface LIN-UART (UARTF)

Below is a list of API functions output by the Code Generator for asynchronous serial interface LIN-UART (UARTF) use.

Table C-26. API Functions: [Asynchronous Serial Interface LIN-UART]

API Function Name	Function
R_UARTFn_Create	Performs initialization necessary to control the asynchronous serial interface LIN-UART (UARTF).
R_UARTFn_Create_UserInit	Performs user-defined initialization related to the asynchronous serial interface LIN-UART (UARTF).
r_uartfn_interrupt_send	Performs processing in response to the LIN-UART transmission end interrupt INTLT.
r_uartfn_interrupt_receive	Performs processing in response to the LIN-UART reception end interrupt INTLR.
r_uartfn_interrupt_error	Performs processing in response to the LIN-UART reception status interrupt INTLS.
R_UARTFn_Start	Sets LIN communication to standby mode.
R_UARTFn_Stop	Ends LIN communication.
R_UARTFn_Set_PowerOff	Halts the clock supplied to the asynchronous serial interface LIN-UART (UARTF).
R_UARTFn_Send	Starts UARTF data transmission.
R_UARTFn_Receive	Starts UARTF data reception.
R_UARTFn_Set_DataComparisonOn	Starts the data comparison.
R_UARTFn_Set_DataComparisonOff	Ends the data comparison.
r_uartfn_callback_sendend	Performs processing in response to the LIN-UART transmission end interrupt INTLT.
r_uartfn_callback_receiveend	Performs processing in response to the LIN-UART reception end interrupt INTLR.
r_uartfn_callback_error	Performs processing in response to the LIN-UART reception status interrupt INTLS.
r_uartfn_callback_softwareoverrun	Performs processing in response to detection of overrun error.
r_uartfn_callback_expbitdetect	Performs processing in response to detection of expansion bit.
r_uartfn_callback_idmatch	Performs processing in response to match of ID parity.

R_UARTF*n*_Create

Performs initialization necessary to control the asynchronous serial interface LIN-UART (UARTF).

[Syntax]

```
void    R_UARTFn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Create_UserInit

Performs user-defined initialization related to the asynchronous serial interface LIN-UART (UARTF).

Remark This API function is called as the R_UARTFn_Create callback routine.

[Syntax]

```
void    R_UARTFn_Create_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_interrupt_send

Performs processing in response to the LIN-UART transmission end interrupt INTLT.

Remark This API function is called as the interrupt process corresponding to the LIN-UART transmission end interrupt INTLT.

[Syntax]

```
__interrupt static  void    r_uartfn_interrupt_send ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_interrupt_receive

Performs processing in response to the LIN-UART reception end interrupt INTLR.

Remark This API function is called as the interrupt process corresponding to the LIN-UART reception end interrupt INTLR.

[Syntax]

```
__interrupt static  void    r_uartfn_interrupt_receive ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_interrupt_error

Performs processing in response to the LIN-UART reception status interrupt INTLS.

Remark This API function is called as the interrupt process corresponding to the LIN-UART reception status interrupt INTLS.

[Syntax]

```
__interrupt static  void    r_uartfn_interrupt_error ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Start

Sets LIN communication to standby mode.

[Syntax]

```
void    R_UARTFn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Stop

Ends LIN communication.

[Syntax]

```
void    R_UARTFn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Set_PowerOff

Halts the clock supplied to the asynchronous serial interface LIN-UART (UARTF).

Remark Calling this API function changes the asynchronous serial interface LIN-UART (UARTF) to reset status. For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_UARTFn_Set_PowerOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Send

Starts UARTF data transmission.

Remarks 1. This API function repeats the byte-level UARTF transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

2. When performing a UARTF transmission, R_UARTFn_Start must be called before this API function is called.

3. If the asynchronous serial interface LIN-UART (UARTF) is used in expansion bit mode, then store the data to send in the buffer specified by argument *tx_buf*, in the following format.

"8-bit data", "Expansion bit", "8-bit data", "Expansion bit", ...

[Syntax]

```
MD_STATUS   R_UARTFn_Send ( uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification
MD_DATAEXISTS	Executing transmission process

R_UARTF*n*_Receive

Starts UARTF data reception.

Remarks 1. This API function performs byte-level UARTF reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

2. Actual UARTF reception starts after this API function is called, and R_UARTFn_Start is then called.

3. If the asynchronous serial interface LIN-UART (UARTF) is used in expansion bit mode, then the received data is stored in the buffer specified by argument *rx_buf*, in the following format.

"8-bit data", "Expansion bit", "8-bit data", "Expansion bit", ...

[Syntax]

```
MD_STATUS   R_UARTFn_Receive ( uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

R_UARTF*n*_Set_DataComparisonOn

Starts the data comparison.

Remark Calling this API function switches the asynchronous serial interface LIN-UART (UARTF) to expansion bit mode (with data comparison).

[Syntax]

```
void    R_UARTFn_Set_DataComparisonOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_UARTF*n*_Set_DataComparisonOff

Ends the data comparison.

Remark Calling this API function switches the asynchronous serial interface LIN-UART (UARTF) to expansion bit mode (with no data comparison).

[Syntax]

```
void    R_UARTFn_Set_DataComparisonOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_callback_sendend

Performs processing in response to the LIN-UART transmission end interrupt INTLT.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_send corresponding to the LIN-UART transmission end interrupt INTLT (performed when number of transmission data specified by R_UARTFn_Send argument *tx_num* has been completed).

[Syntax]

```
static  void    r_uartfn_callback_sendend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_callback_receiveend

Performs processing in response to the LIN-UART reception end interrupt INTLR.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_receive corresponding to the LIN-UART reception end interrupt INTLR (performed when number of received data specified by R_UARTFn_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_uartfn_callback_receiveend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_callback_error

Performs processing in response to the LIN-UART reception status interrupt INTLS.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_error corresponding to the LIN-UART reception status interrupt INTLS.

[Syntax]

```
static  void    r_uartfn_callback_error ( uint8_t err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t err_type;`	Trigger for LIN-UART reception status interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Parity error 000001*xx*B: Framing error

[Return value]

None.

r_uartf*n*_callback_softwareoverrun

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_receive corresponding to the LIN-UART reception end interrupt INTLR (performed when number of received data specified by R_UARTFn_Receive argument *rx_num* has been completed).

[Syntax]

```
static  void    r_uartfn_callback_softwareoverrun ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_callback_expbitdetect

Performs processing in response to detection of expansion bit.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_error corresponding to the LIN-UART reception status interrupt INTLS (performed when expansion bit has been detected).

[Syntax]

```
static  void    r_uartfn_callback_expbitdetect ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_uartf*n*_callback_idmatch

Performs processing in response to match ID parity.

Remark This API function is called as the callback routine of interrupt process r_uartfn_interrupt_error corresponding to the LIN-UART reception status interrupt INTLS (performed when ID parity has been matched).

[Syntax]

```
static  void    r_uartfn_callback_idmatch ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.2.27 Serial interface IICA

Below is a list of API functions output by the Code Generator for serial interface IICA use.

Table C-27. API Functions: [Serial Interface IICA]

API Function Name	Function
R_IICAn_Create	Performs initialization necessary to control the serial interface IICA.
R_IICAn_Create_UserInit	Performs user-defined initialization related to the serial interface IICA.
r_iican_interrupt	Performs processing in response to the IICA communication end interrupt INTIICA*n*.
R_IICAn_StopCondition	Generates stop conditions.
R_IICAn_Stop	Ends IICA communication.
R_IICAn_Set_PowerOff	Halts the clock supplied to the serial interface IICA.
R_IICAn_Master_Send	Starts IICA master transmission.
R_IICAn_Master_Receive	Starts IICA master reception.
r_iican_callback_master_sendend	Performs processing in response to the IICA master transmission end interrupt INTIICA*n*.
r_iican_callback_master_receiveend	Performs processing in response to the IICA master reception end interrupt INTIICA*n*.
r_iican_callback_master_error	Performs processing in response to detection of IICA master communication error.
R_IICAn_Slave_Send	Starts IICA slave transmission.
R_IICAn_Slave_Receive	Starts IICA slave reception.
r_iican_callback_slave_sendend	Performs processing in response to the IICA slave transmission end interrupt INTIICA*n*.
r_iican_callback_slave_receiveend	Performs processing in response to the IICA slave reception end interrupt INTIICA*n*.
r_iican_callback_slave_error	Performs processing in response to detection of IICA slave communication error.
r_iican_callback_getstopcondition	Performs processing in response to detection of stop condition.
R_IICAn_Set_SnoozeOn	Enables operation of the address match wakeup function in STOP mode.
R_IICAn_Set_SnoozeOff	Disables operation of the address match wakeup function in STOP mode.
R_IICAn_Set_WakeupOn	Enables operation of the address match wakeup function in STOP mode.
R_IICAn_Set_WakeupOff	Disables operation of the address match wakeup function in STOP mode.

R_IICA*n*_Create

Performs initialization necessary to control the serial interface IICA.

[Syntax]

```
void    R_IICAn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Create_UserInit

Performs user-defined initialization related to the serial interface IICA.

Remark This API function is called as the R_IICAn_Create callback routine.

[Syntax]

```
void    R_IICAn_Create_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iica*n*_interrupt

Performs processing in response to the IICA communication end interrupt INTIICA*n*.

Remark This API function is called as the interrupt process corresponding to the IICA communication end interrupt INTIICA*n*.

[Syntax]

```
__interrupt static  void    r_iican_interrupt ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_StopCondition

Generates stop conditions.

[Syntax]

```
void    R_IICAn_StopCondition ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Stop

Ends IICA communication.

[Syntax]

```
void    R_IICAn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Set_PowerOff

Halts the clock supplied to the serial interface IICA.

Remark Calling this API function changes the serial interface IICA to reset status.
For this reason, writes to the control registers (e.g. IICA control register *n*: IICCTL*n*) after this API function is called are ignored.

[Syntax]

```
void    R_IICAn_Set_PowerOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Master_Send

Starts IICA master transmission.

Remark This API function repeats the byte-level IICA master transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_IICAn_Master_Send ( uint8_t adr, uint8_t * const tx_buf, uint16_t tx_num,
uint8_t wait );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t adr;`	Slave address
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send
I	`uint8_t wait;`	Setup time of start conditions

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR1	Bus communication status
MD_ERROR2	Bus not released status

R_IICA*n*_Master_Receive

Starts IICA master reception.

Remark This API function performs byte-level IICA master reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
MD_STATUS   R_IICAn_Master_Receive ( uint8_t adr, uint8_t * const rx_buf, uint16_t rx_num,
uint8_t wait );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t adr;`	Slave address
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive
I	`uint8_t wait;`	Setup time of start conditions

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR1	Bus communication status
MD_ERROR2	Bus not released status

r_iica*n*_callback_master_sendend

Performs processing in response to the IICA master transmission end interrupt INTIICA*n*.

Remark This API function is called as the callback routine of interrupt process r_iican_interrupt corresponding to the IICA master transmission end interrupt INTIICA*n*.

[Syntax]

```
static  void    r_iican_callback_master_sendend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iica*n*_callback_master_receiveend

Performs processing in response to the IICA master reception end interrupt INTIICA*n*.

Remark This API function is called as the callback routine of interrupt process r_iican_interrupt corresponding to the IICA master reception end interrupt INTIICA*n*.

[Syntax]

```
static  void    r_iican_callback_master_receiveend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iica*n*_callback_master_error

Performs processing in response to detection of IICA master communication error.

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_iican_callback_master_error ( MD_STATUS flag  );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`MD_STATUS flag;`	Cause of communication error MD_SPT: Stop condition detected MD_NACK: Acknowledge not detected

[Return value]

None.

R_IICA*n*_Slave_Send

Starts IICA slave transmission.

Remark This API function repeats the byte-level IICA slave transmission from the buffer specified in argument *tx_buf* the number of times specified in argument *tx_num*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_IICAn_Slave_Send ( uint8_t * const tx_buf, uint16_t tx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`uint8_t * const tx_buf;`	Pointer to a buffer storing the transmission data
I	`uint16_t tx_num;`	Total amount of data to send

[Return value]

None.

R_IICA*n*_Slave_Receive

Starts IICA slave reception.

Remark This API function performs byte-level IICA slave reception the number of times specified by the argument *rx_num*, and stores the data in the buffer specified by the argument *rx_buf*.

[Syntax]

```
#include    "r_cg_macrodriver.h"
void    R_IICAn_Slave_Receive ( uint8_t * const rx_buf, uint16_t rx_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`uint8_t * const rx_buf;`	Pointer to a buffer to store the received data
I	`uint16_t rx_num;`	Total amount of data to receive

[Return value]

None.

r_iica*n*_callback_slave_sendend

Performs processing in response to the IICA slave transmission end interrupt INTIICA*n*.

Remark This API function is called as the callback routine of interrupt process r_iican_interrupt corresponding to the IICA slave transmission end interrupt INTIICA*n*.

[Syntax]

```
static  void    r_iican_callback_slave_sendend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iica*n*_callback_slave_receiveend

Performs processing in response to the IICA slave reception end interrupt INTIICA*n*.

Remark This API function is called as the callback routine of interrupt process r_iican_interrupt corresponding to the IICA slave reception end interrupt INTIICA*n*.

[Syntax]

```
static  void    r_iican_callback_slave_receiveend ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

r_iica*n*_callback_slave_error

Performs processing in response to detection of IICA slave communication error.

[Syntax]

```
#include    "r_cg_macrodriver.h"
static  void    r_iican_callback_slave_error ( MD_STATUS flag  );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`MD_STATUS flag;`	Cause of communication error MD_ERROR: Address mismatch detected MD_NACK: Acknowledge not detected

[Return value]

None.

r_iica*n*_callback_getstopcondition

Performs processing in response to detection of stop condition.

[Syntax]

```
static  void    r_iican_callback_getstopcondition ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Set_SnoozeOn

Enables operation of the address match wakeup function in STOP mode.

[Syntax]

```
void    R_IICAn_Set_SnoozeOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Set_SnoozeOff

Disables operation of the address match wakeup function in STOP mode.

[Syntax]

```
void    R_IICAn_Set_SnoozeOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Set_WakeupOn

Enables operation of the address match wakeup function in STOP mode.

[Syntax]

```
void    R_IICAn_Set_WakeupOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_IICA*n*_Set_WakeupOff

Disables operation of the address match wakeup function in STOP mode.

[Syntax]

```
void    R_IICAn_Set_WakeupOff ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.2.28 LCD controller/driver

Below is a list of API functions output by the Code Generator for LCD controller/driver use.

Table C-28. API Functions: [LCD Controller/Driver]

API Function Name	Function
R_LCD_Create	Performs initialization necessary to control the LCD controller/driver.
R_LCD_Create_UserInit	Performs user-defined initialization relating to the LCD controller/driver.
r_lcd_interrupt	Performs processing in response to the LCD frame interrupt INTLCD.
R_LCD_Start	Sets the LCD controller/driver to display on status.
R_LCD_Stop	Sets the LCD controller/driver to display off status.
R_LCD_Set_VoltageOn	Enables operation of internal voltage boost circuit and capacitor split circuit.
R_LCD_Set_VoltageOff	Disables operation of internal voltage boost circuit and capacitor split circuit.
R_LCD_Set_PowerOff	Halts the clock supplied to the LCD controller/driver.

R_LCD_Create

Performs initialization necessary to control the LCD controller/driver.

[Syntax]

```
void    R_LCD_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Create_UserInit

Performs user-defined initialization relating to the LCD controller/driver.

Remark This API function is called as the R_LCD_Create callback routine.

[Syntax]

```
void    R_LCD_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_lcd_interrupt

Performs processing in response to the LCD frame interrupt INTLCD.

Remark This API function is called as the interrupt process corresponding to the LCD frame interrupt INTLCD.

[Syntax]

```
__interrupt static  void    r_lcd_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Start

Sets the LCD controller/driver to display on status.

[Syntax]

```
void    R_LCD_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Stop

Sets the LCD controller/driver to display off status.

[Syntax]

```
void    R_LCD_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Set_VoltageOn

Enables operation of internal voltage boost circuit and capacitor split circuit.

[Syntax]

```
void    R_LCD_Set_VoltageOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Set_VoltageOff

Disables operation of internal voltage boost circuit and capacitor split circuit.

[Syntax]

```
void    R_LCD_Set_VoltageOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LCD_Set_PowerOff

Halts the clock supplied to the LCD controller/driver.

Remarks 1. Calling this API function changes the LCD controller/driver to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

2. This API function stops the clock supply to the LCD controller/driver, by operating the RTCEN bit of peripheral enable register *n*.
For this reason, this API function also stops the clock supply to other peripheral devices sharing the RTCEN bit (e.g. real-time clock).

[Syntax]

```
void    R_LCD_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.29 Sound generator

Below is a list of API functions output by the Code Generator for sound generator use.

Table C-29. API Functions: [Sound Generator]

API Function Name	Function
R_SG_Create	Performs initialization necessary to control the sound generator.
R_SG_Create_UserInit	Performs user-defined initialization relating to the sound generator.
r_sg_interrupt	Performs processing in response to the threshold value detection of the logarithmic decrement interrupt INTSG.
R_SG_Start	Enables operation of sound generator.
R_SG_Stop	Disables operation of sound generator.

R_SG_Create

Performs initialization necessary to control the sound generator.

[Syntax]

```
void    R_SG_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_SG_Create_UserInit

Performs user-defined initialization relating to the sound generator.

Remark This API function is called as the R_SG_Create callback routine.

[Syntax]

```
void    R_SG_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_sg_interrupt

Performs processing in response to the threshold value detection of the logarithmic decrement interrupt INTSG.

Remark This API function is called as the interrupt process corresponding to the threshold value detection of the logarithmic decrement interrupt INTSG.

[Syntax]

```
__interrupt static  void    r_sg_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_SG_Start

Enables operation of sound generator.

[Syntax]

```
void    R_SG_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_SG_Stop

Disables operation of sound generator.

[Syntax]

```
void    R_SG_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.30 DMA controller

Below is a list of API functions output by the Code Generator for DMA controller use.

Table C-30. API Functions: [DMA Controller]

API Function Name	Function
R_DMACn_Create	Performs initialization necessary to control the DMA controller.
R_DMACn_Create_UserInit	Performs user-defined initialization relating to the DMA controller.
R_DMAC_Create	Performs initialization necessary to control the DMA controller.
R_DMAC_Create_UserInit	Performs user-defined initialization relating to the DMA controller.
r_dmacn_interrupt	Performs processing in response to the DMA transfer end interrupt INTDMA*n*.
R_DMACn_Start	Enables operation of channel *n*.
R_DMACn_Stop	Disables operation of channel *n*.
R_DMACn_Set_SoftwareTriggerOn	Starts DMA transfer.

R_DMAC*n*_Create

Performs initialization necessary to control the DMA controller.

[Syntax]

```
void    R_DMACn_Create ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DMAC*n*_Create_UserInit

Performs user-defined initialization relating to the DMA controller.

Remark This API function is called as the R_DMACn_Create callback routine.

[Syntax]

```
void    R_DMACn_Create_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DMAC_Create

Performs initialization necessary to control the DMA controller.

[Syntax]

```
void    R_DMAC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DMAC_Create_UserInit

Performs user-defined initialization relating to the DMA controller.

Remark This API function is called as the R_DMAC_Create callback routine.

[Syntax]

```
void    R_DMAC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_dmac*n*_interrupt

Performs processing in response to the DMA transfer end interrupt INTDMA*n*.

Remark This API function is called as the interrupt process corresponding to the DMA transfer end interrupt INTDMA*n*.

[Syntax]

```
__interrupt static  void    r_dmacn_interrupt ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DMAC*n*_Start

Enables operation of channel *n*.

[Syntax]

```
void    R_DMACn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DMAC*n*_Stop

Disables operation of channel *n*.

Remarks 1. This API function does not forcibly terminate DMA transfer.

2. Before using this API function, you must confirm that transmission has ended.

[Syntax]

```
void    R_DMACn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DMAC*n*_Set_SoftwareTriggerOn

Starts DMA transfer.

[Syntax]

```
void    R_DMACn_Set_SoftwareTriggerOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.2.31 DTC

Below is a list of API functions output by the Code Generator for DTC use.

Table C-31. API Functions: [DTC]

API Function Name	Function
R_DTC_Create	Performs initialization necessary to control the DTC.
R_DTC_Create_UserInit	Performs user-defined initialization relating to the DTC.
R_DTCn_Start	Enables operation of the DTC.
R_DTCn_Stop	Disables operation of the DTC.
R_DTC_Set_PowerOff	Halts the clock supplied to the DTC.

R_DTC_Create

Performs initialization necessary to control the DTC.

[Syntax]

```
void    R_DTC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DTC_Create_UserInit

Performs user-defined initialization relating to the DTC.

Remark This API function is called as the R_DTC_Create callback routine.

[Syntax]

```
void    R_DTC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_DTC*n*_Start

Enables operation of the DTC.

[Syntax]

```
void    R_DTCn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DTC*n*_Stop

Disables operation of the DTC.

[Syntax]

```
void    R_DTCn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

R_DTC_Set_PowerOff

Halts the clock supplied to the DTC.

Remark Calling this API function changes the DTC to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_DTC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.32 Event link controller (ELC)

Below is a list of API functions output by the Code Generator for event link controller (ELC) use.

Table C-32. API Functions: [Event Link Controller]

API Function Name	Function
R_ELC_Create	Performs initialization necessary to control the event link controller (ELC).
R_ELC_Create_UserInit	Performs user-defined initialization relating to the event link controller (ELC).
R_ELC_Stop	Disables operation of the event link controller (ELC).

R_ELC_Create

Performs initialization necessary to control the event link controller (ELC).

[Syntax]

```
void    R_ELC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ELC_Create_UserInit

Performs user-defined initialization relating to the event link controller (ELC).

Remark This API function is called as the R_ELC_Create callback routine.

[Syntax]

```
void    R_ELC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_ELC_Stop

Disables operation of the event link controller (ELC).

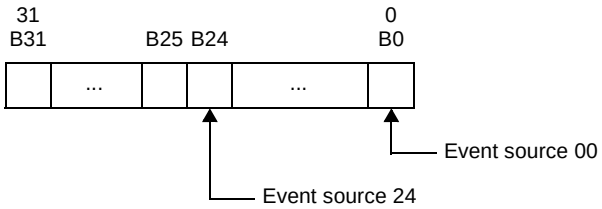
[Syntax]

```
void    R_ELC_Stop ( uint32_t event );
```

[Argument(s)]

I/O	Argument	Description
I	`uint32_t event;`	Disabled event source

Remark Below is shown the format for specifying disabled event source *event*.
In case of setting the *event* to 0x01010101, the event link operations of event source 00, 08, 16, 24 are prohibited.



[Return value]

None.

C.2.33 Interrupt functions

Below is a list of API functions output by the Code Generator for interrupt functions use.

Table C-33. API Functions: [Interrupt Functions]

API Function Name	Function
R_INTC_Create	Performs initialization necessary to control the interrupt functions.
R_INTC_Create_UserInit	Performs user-defined initialization relating to the interrupt functions.
r_intcn_interrupt	Performs processing in response to the external maskable interrupt INTP*n*.
R_INTCn_Start	Enables the acceptance of the external maskable interrupts INTP*n*.
R_INTCn_Stop	Disables the acceptance of the external maskable interrupts INTP*n*.
r_intclrn_interrupt	Performs processing in response to the external maskable interrupt INTPLR*n*.
R_INTCLRn_Start	Enables the acceptance of the external maskable interrupts INTPLR*n*.
R_INTCLRn_Stop	Disables the acceptance of the external maskable interrupts INTPLR*n*.

R_INTC_Create

Performs initialization necessary to control the interrupt functions.

[Syntax]

```
void    R_INTC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_INTC_Create_UserInit

Performs user-defined initialization relating to the interrupt functions.

Remark This API function is called as the R_INTC_Create callback routine.

[Syntax]

```
void    R_INTC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_intc*n*_interrupt

Performs processing in response to the external maskable interrupt INTP*n*.

Remark This API function is called as the interrupt process corresponding to the external maskable interrupt INTP*n*.

[Syntax]

```
__interrupt static  void    r_intcn_interrupt ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

R_INTC*n*_Start

Enables the acceptance of the external maskable interrupts INTP*n*.

[Syntax]

```
void    R_INTCn_Start ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

R_INTC*n*_Stop

Disables the acceptance of the external maskable interrupts INTP*n*.

[Syntax]

```
void    R_INTCn_Stop ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

r_intclr*n*_interrupt

Performs processing in response to the external maskable interrupt INTPLR*n*.

Remark This API function is called as the interrupt process corresponding to the external maskable interrupt INTPLR*n*.

[Syntax]

```
__interrupt static  void    r_intclrn_interrupt ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

R_INTCLR*n*_Start

Enables the acceptance of the external maskable interrupts INTPLR*n*.

[Syntax]

```
void    R_INTCLRn_Start ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

R_INTCLR*n*_Stop

Disables the acceptance of the external maskable interrupts INTPLR*n*.

[Syntax]

```
void    R_INTCLRn_Stop ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

C.2.34 Key interrupt function

Below is a list of API functions output by the Code Generator for key interrupt function use.

Table C-34. API Functions: [Key Interrupt Function]

API Function Name	Function
R_KEY_Create	Performs initialization necessary to control the key interrupt function.
R_KEY_Create_UserInit	Performs user-defined initialization relating to the key interrupt function.
r_key_interrupt	Performs processing in response to the key interrupt INTKR.
R_KEY_Start	Enables the acceptance of the key interrupt INTKR.
R_KEY_Stop	Disables the acceptance of the key interrupt INTKR.

R_KEY_Create

Performs initialization necessary to control the key interrupt function.

[Syntax]

```
void    R_KEY_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_KEY_Create_UserInit

Performs user-defined initialization relating to the key interrupt function.

Remark This API function is called as the R_KEY_Create callback routine.

[Syntax]

```
void    R_KEY_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_key_interrupt

Performs processing in response to the key interrupt INTKR.

Remark This API function is called as the interrupt process corresponding to the key interrupt INTKR.

[Syntax]

```
__interrupt static  void    r_key_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_KEY_Start

Enables the acceptance of the key interrupt INTKR.

[Syntax]

```
void    R_KEY_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_KEY_Stop

Disables the acceptance of the key interrupt INTKR.

[Syntax]

```
void    R_KEY_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.35 Voltage detector

Below is a list of API functions output by the Code Generator for voltage detector use.

Table C-35. API Functions: [Voltage Detector]

API Function Name	Function
R_LVD_Create	Performs initialization necessary to control the voltage detector.
R_LVD_Create_UserInit	Performs user-defined initialization relating to the voltage detector.
r_lvd_interrupt	Performs processing in response to the voltage detection interrupt INTLVI.
R_LVD_InterruptMode_Start	Starts voltage detection (when in interrupt mode, and interrupt & reset mode).

R_LVD_Create

Performs initialization necessary to control the voltage detector.

[Syntax]

```
void    R_LVD_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LVD_Create_UserInit

Performs user-defined initialization relating to the voltage detector.

Remark This API function is called as the R_LVD_Create callback routine.

[Syntax]

```
void    R_LVD_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_lvd_interrupt

Performs processing in response to the voltage detection interrupt INTLVI.

Remark This API function is called as the interrupt process corresponding to the voltage detection interrupt INTLVI.

[Syntax]

```
__interrupt static  void    r_lvd_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_LVD_InterruptMode_Start

Starts voltage detection (when in interrupt mode, and interrupt & reset mode).

[Syntax]

```
void    R_LVD_InterruptMode_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.36 Battery backup function

Below is a list of API functions output by the Code Generator for battery backup function use.

Table C-36. API Functions: [Battery Backup Function]

API Function Name	Function
R_BUP_Create	Performs initialization necessary to control the battery backup function.
R_BUP_Create_UserInit	Performs user-defined initialization relating to the battery backup function.
r_bup_interrupt	Performs processing in response to the power switching detection interrupt INTVBAT.
R_BUP_Start	Enables operation of battery backup function.
R_BUP_Stop	Disables operation of battery backup function.

R_BUP_Create

Performs initialization necessary to control the battery backup function.

[Syntax]

```
void    R_BUP_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_BUP_Create_UserInit

Performs user-defined initialization relating to the battery backup function.

Remark This API function is called as the R_BUP_Create callback routine.

[Syntax]

```
void    R_BUP_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_bup_interrupt

Performs processing in response to the power switching detection interrupt INTVBAT.

Remark This API function is called as the interrupt process corresponding to the power switching detection interrupt INTVBAT.

[Syntax]

```
__interrupt static  void    r_bup_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_BUP_Start

Enables operation of battery backup function.

[Syntax]

```
void    R_BUP_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_BUP_Stop

Disables operation of battery backup function.

[Syntax]

```
void    R_BUP_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.37 Oscillation stop detector

Below is a list of API functions output by the Code Generator for oscillation stop detector use.

Table C-37. API Functions: [Oscillation Stop Detector]

API Function Name	Function
R_OSDC_Create	Performs initialization necessary to control the oscillation stop detector.
R_OSDC_Create_UserInit	Performs user-defined initialization relating to the oscillation stop detector.
r_osdc_interrupt	Performs processing in response to the oscillation stop detection interrupt INTOSDC.
R_OSDC_Start	Enables operation of oscillation stop detector.
R_OSDC_Stop	Disables operation of oscillation stop detector.
R_OSDC_Set_PowerOff	Halts the clock supplied to the oscillation stop detector.

R_OSDC_Create

Performs initialization necessary to control the oscillation stop detector.

[Syntax]

```
void    R_OSDC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_OSDC_Create_UserInit

Performs user-defined initialization relating to the oscillation stop detector.

Remark This API function is called as the R_OSDC_Create callback routine.

[Syntax]

```
void    R_OSDC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

r_osdc_interrupt

Performs processing in response to the oscillation stop detection interrupt INTOSDC.

Remark This API function is called as the interrupt process corresponding to the oscillation stop detection interrupt INTOSDC.

[Syntax]

```
__interrupt static  void    r_osdc_interrupt ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_OSDC_Start

Enables operation of oscillation stop detector.

[Syntax]

```
void    R_OSDC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_OSDC_Stop

Disables operation of oscillation stop detector.

[Syntax]

```
void    R_OSDC_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_OSDC_Set_PowerOff

Halts the clock supplied to the oscillation stop detector.

Remark Calling this API function changes the oscillation stop detector to reset status.
For this reason, writes to the control registers after this API function is called are ignored.

[Syntax]

```
void    R_OSDC_Set_PowerOff ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.2.38 SPI interface

Below is a list of API functions output by the Code Generator for SPI interface use.

Table C-38. API Functions: [SPI Interface]

API Function Name	Function
R_SAIC_Create	Performs initialization necessary to control the SPI interface.
R_SAIC_Create_UserInit	Performs user-defined initialization relating to the SPI interface.
R_SAIC_Write	Starts SPI data transmission.
R_SAIC_Read	Starts SPI data reception.

R_SAIC_Create

Performs initialization necessary to control the SPI interface.

[Syntax]

```
void    R_SAIC_Create ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_SAIC_Create_UserInit

Performs user-defined initialization relating to the SPI interface.

Remark This API function is called as the R_SAIC_Create callback routine.

[Syntax]

```
void    R_SAIC_Create_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

R_SAIC_Write

Starts SPI data transmission.

[Syntax]

```
void    R_SAIC_Write ( const smartanalog_t * p_saic_data );
```

[Argument(s)]

I/O	Argument	Description
I	`const smartanalog_t * p_saic_data;`	Pointer to area storing the transmission data

[Return value]

None.

R_SAIC_Read

Starts SPI data reception.

[Syntax]

```
void    R_SAIC_Read ( const smartanalog_t * p_saic_data, smartanalog_t * p_saic_read_buf );
```

[Argument(s)]

I/O	Argument	Description
O	`const smartanalog_t * p_saic_data;`	Pointer to area to store the received data
O	`smartanalog_t * p_saic_read_buf;`	Pointer to a buffer to store the received data

[Return value]

None.

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