User's Manual

CubeSuite Ver.1.40

Integrated Development Environment
User's Manual: V850 Design

Target Device
V850 Microcontroller

Renesas Electronics
www.renesas.com

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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 V850 microcontrollers, and provides an outline of its features.

CubeSuite is an integrated development environment (IDE) for V850 microcontrollers, 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
APPENDIX D INDEX

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:	$\overline{XXX}$ (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	R20UT0256E
	Analysis	R20UT0265E
	Programming	R20UT0266E
	Message	R20UT0267E
	Coding for CX compiler	R20UT0259E
	Build for CX compiler	R20UT0261E
	78K0 Coding	R20UT0004E
	78K0 Build	R20UT0005E
	78K0 Debug	R20UT0262E
	78K0 Design	R20UT0006E
	78K0R Coding	U19382E
	78K0R Build	U19385E
	78K0R Debug	R20UT0263E
	78K0R Design	R20UT0007E
	V850 Coding	U19383E
	V850 Build	U19386E
	V850 Debug	R20UT0264E
	V850 Design	This manual

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

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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 for microcontrollers manufactured by Renesas Electronics.

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 provided by the microcontroller (clock generators, external bus interfaces, ports, etc.) 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.
  Source code output by the Code Generator conforms to the MISRA-C (Guidelines for the Use of the C Language in Vehicle Based Software) coding convention.

- 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.

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 the Pin Configurator.

(1) Start CubeSuite

Launch CubeSuite from the [Start] menu of Windows.

Remark See "CubeSuite Start User's Manual" 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 Start User's Manual" 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 infomration

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

(5) Enter Information

Allows you to 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 the 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.

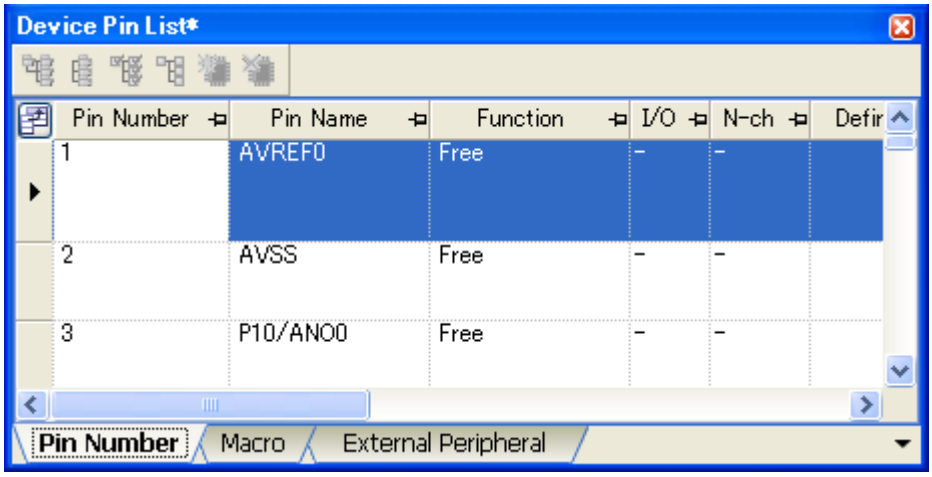
Remark See "CubeSuite Start User's Manual" for details on "Save project".

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, select [*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 the 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.

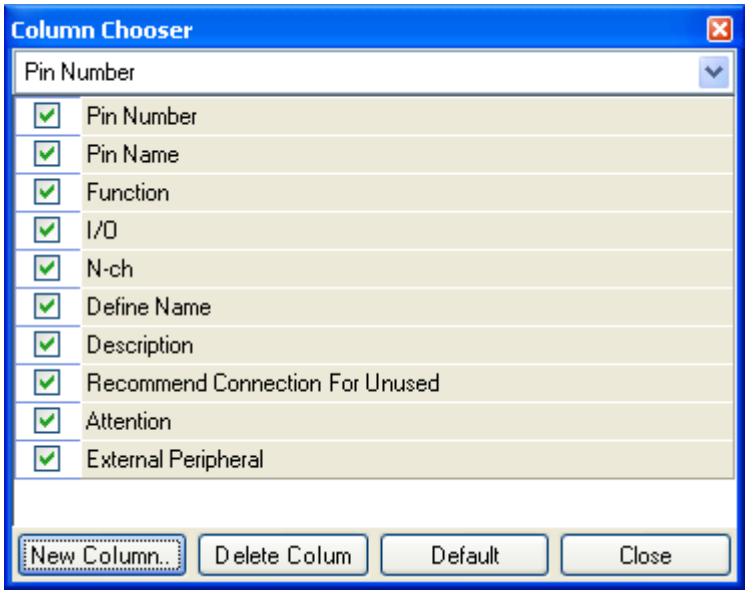
- [Pin Number] tab
  Information on each pin of the microcontroller is displayed in the order of pin number.
- [Macro] tab
  Information on each pin of the microcontroller is displayed in the order it was grouped into peripheral functions.
- [External Peripheral] tab
  Information about the pins connected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

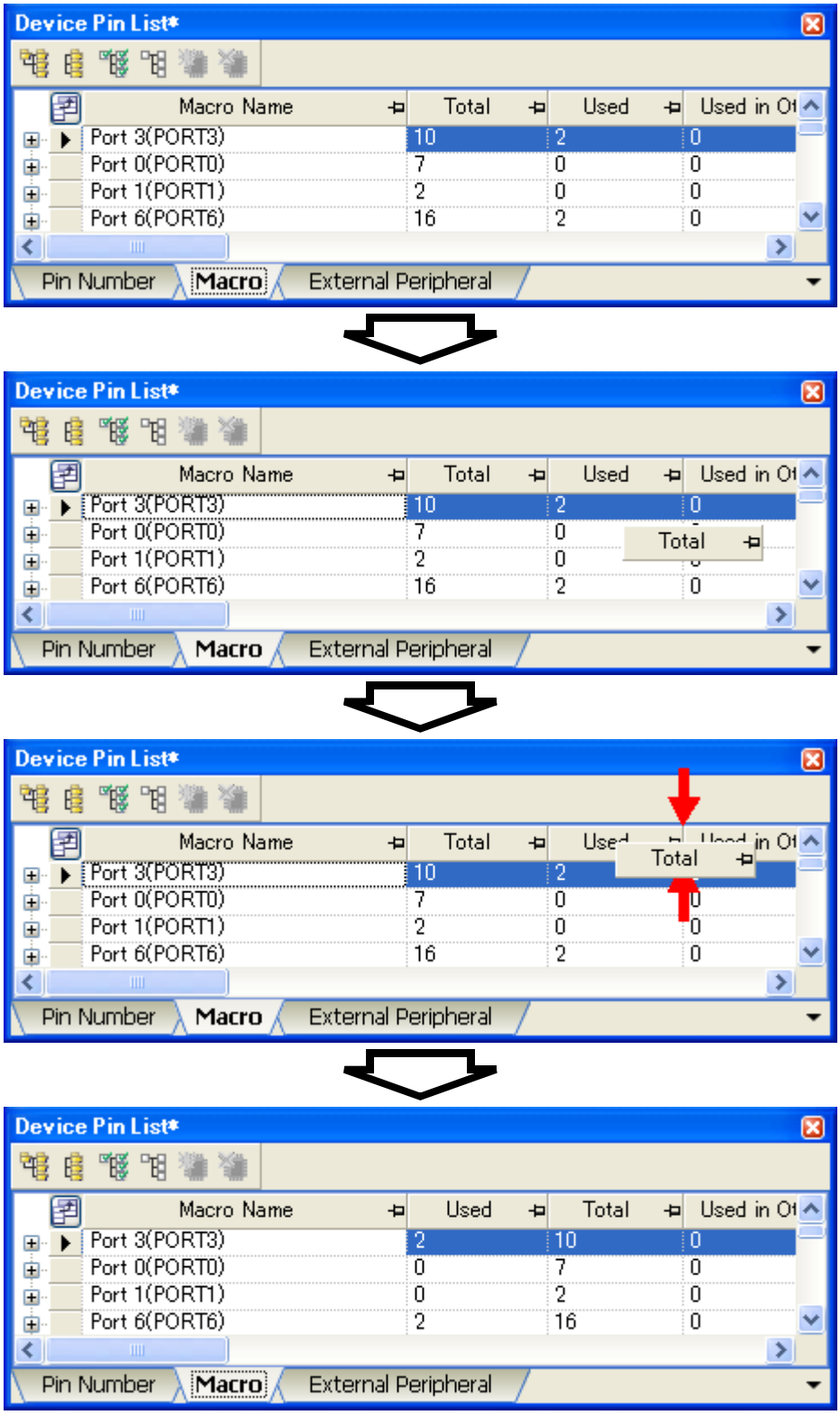
Table 2-1. Select Item

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 the 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



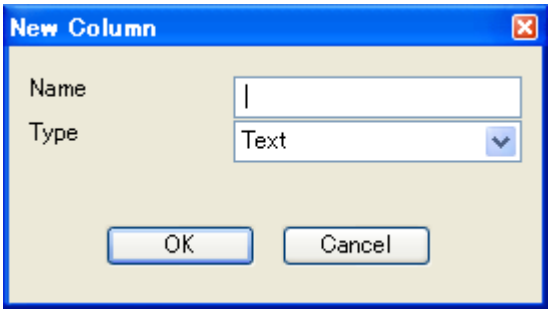
Remark To change the display order, click the button in the upper left of the device pin list. The Column Chooser dialog box opens. Drag an item displayed in the dialog's select Items to display area, and drop it to the desired destination in the device pin list. This will change the display order.

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



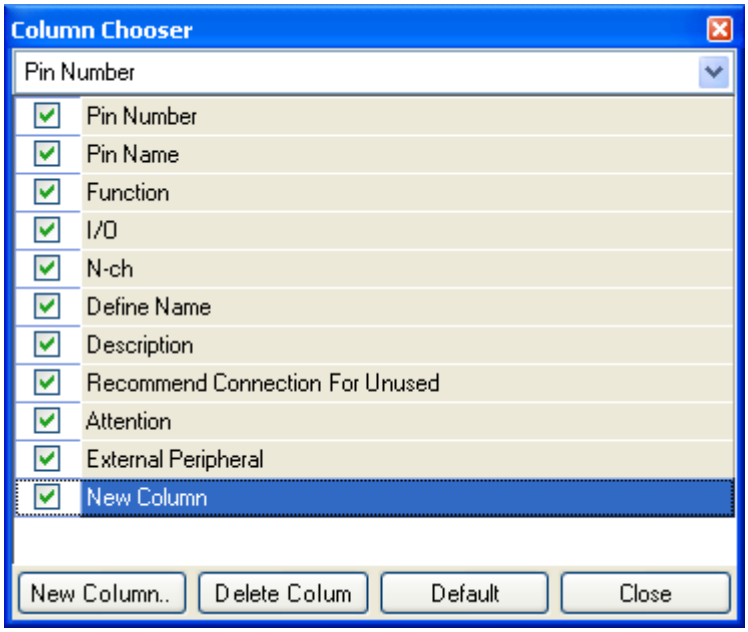
Remark On the device pin list, adding columns to the first level of [Macro] tab, [External Peripheral] tab is restricted.

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



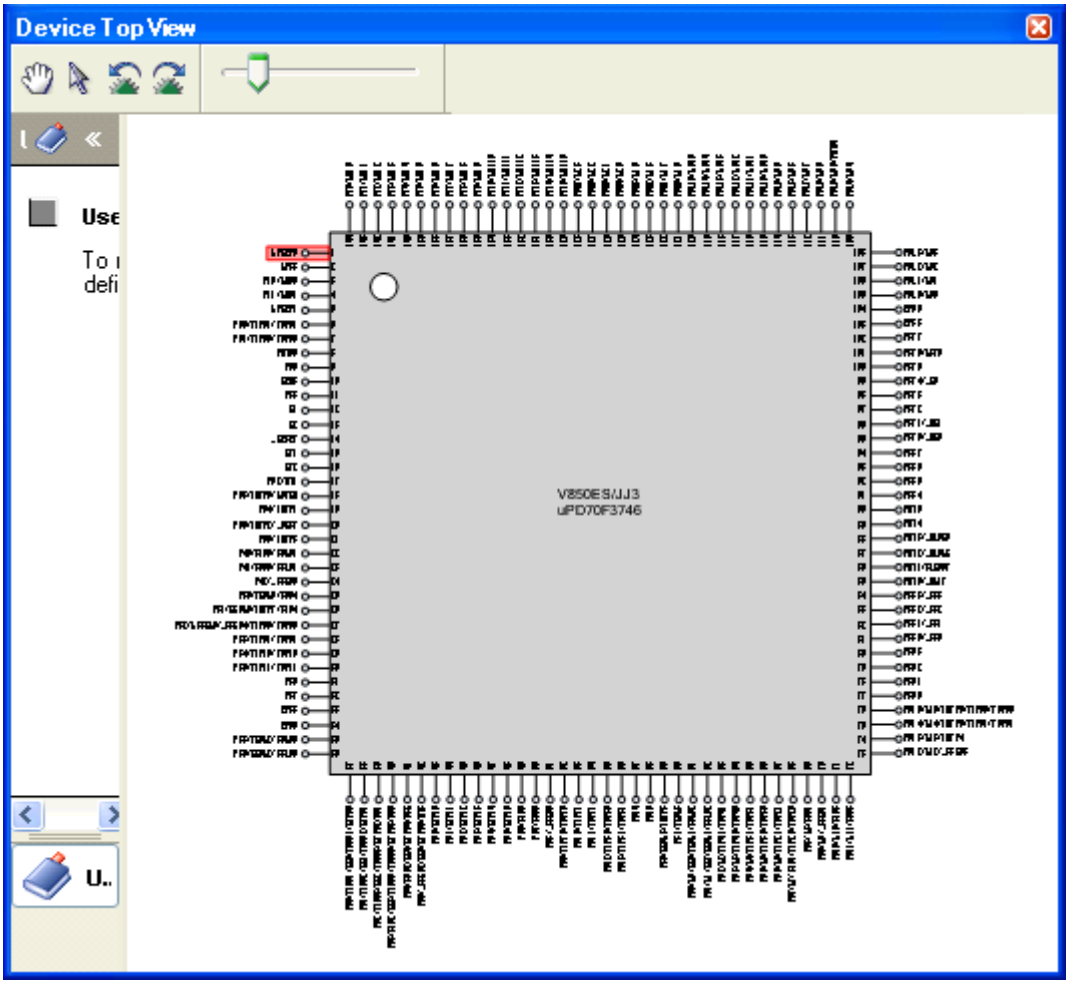
Remark You can only delete the column which you added using the New Column dialog box.

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, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Top View] in the Project Tree panel.

Figure 2-6. Open Device Top View Panel



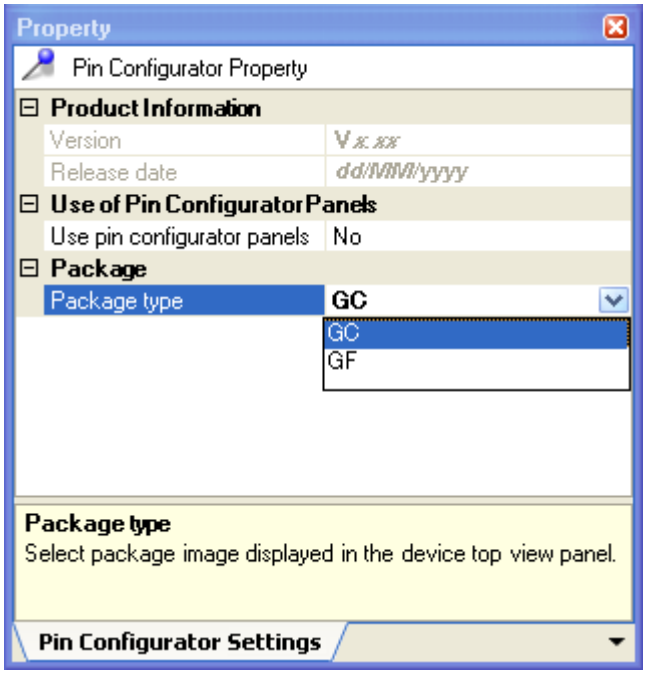
Remark In the Property panel, on the [Pin Configurator Settings] tab, if "BGA" is selected for the Package type, then Device Top View panel cannot be opened.

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 type] in the Property panel and select the desired shape.

Figure 2-7. Select Shape of Microcontroller



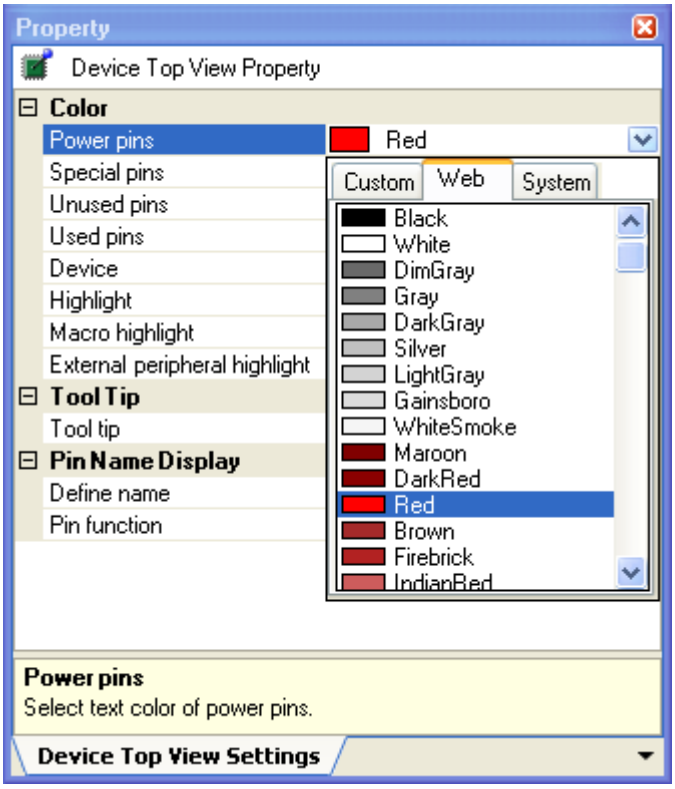
Remark Selection of the shape of the microcontroller is made using the order name (such as GC and GF).

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, select the desired color in the color palette that opens by clicking [Device Top View Settings] tab >> [Color] in the Property panel.

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	Selects the background color of a pin selected in the Device Pin List panel, on the [Pin Number] tab.
Macro highlight	Selects the background color of pins selected in the Device Pin List panel, on the [Macro] tab.

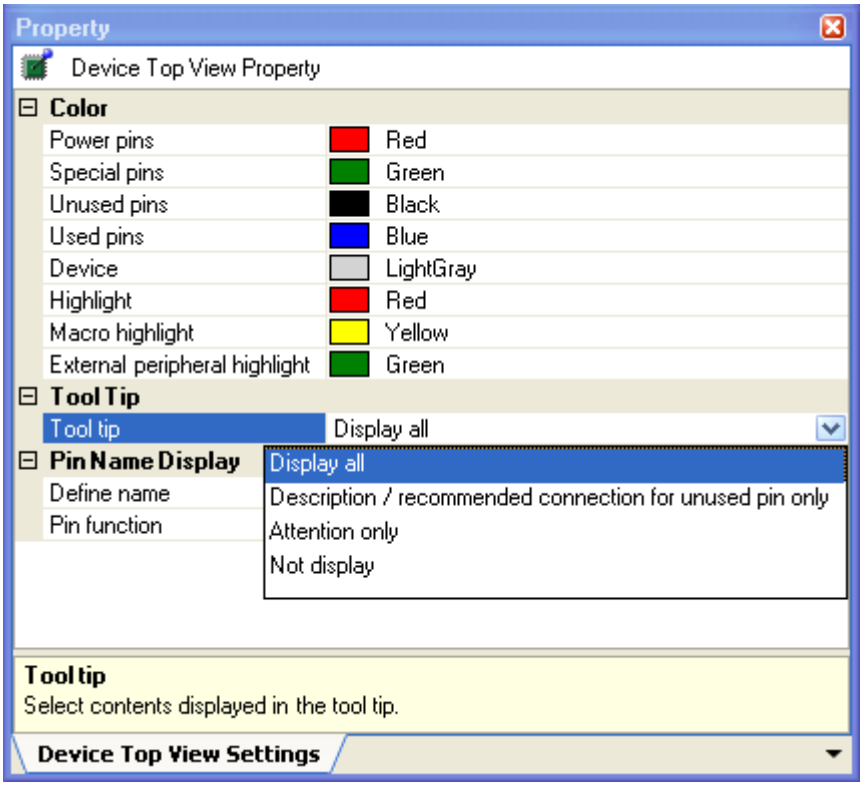
Item	Outline
External peripheral highlight	Selects the background color of pins selected in the Device Pin List panel, on the [External Peripheral] tab.

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] 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

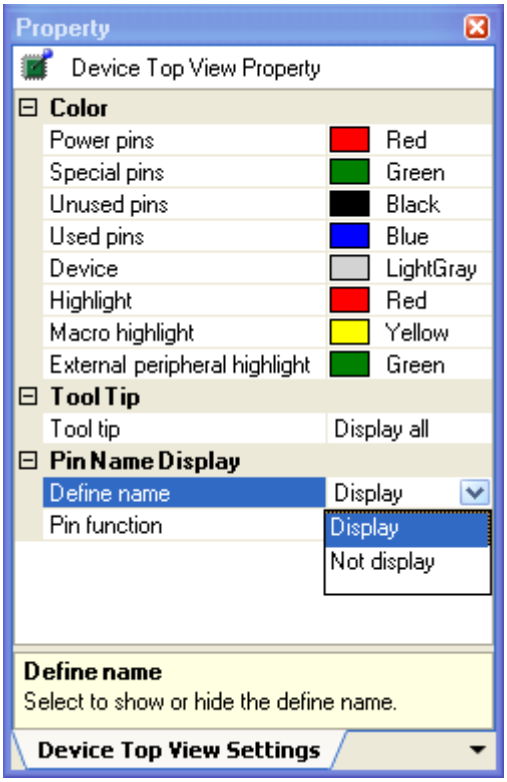
Popup Information	Outline
Display all	Displays the "Description", "Recommend Connection For Unused", and "Attention" strings for the device pin list.
Description / recommended connection for unused pin only	Displays the "Description", and "Recommend Connection For Unused" string for the device pin list.
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 infomration

Select the type of information to display in the 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.

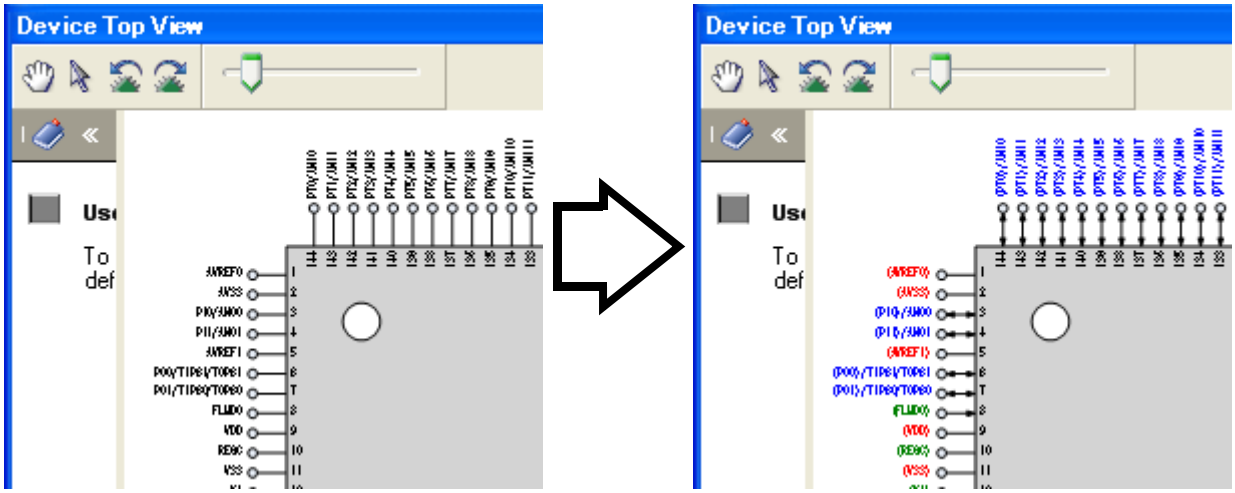
2.4 Enter Information

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

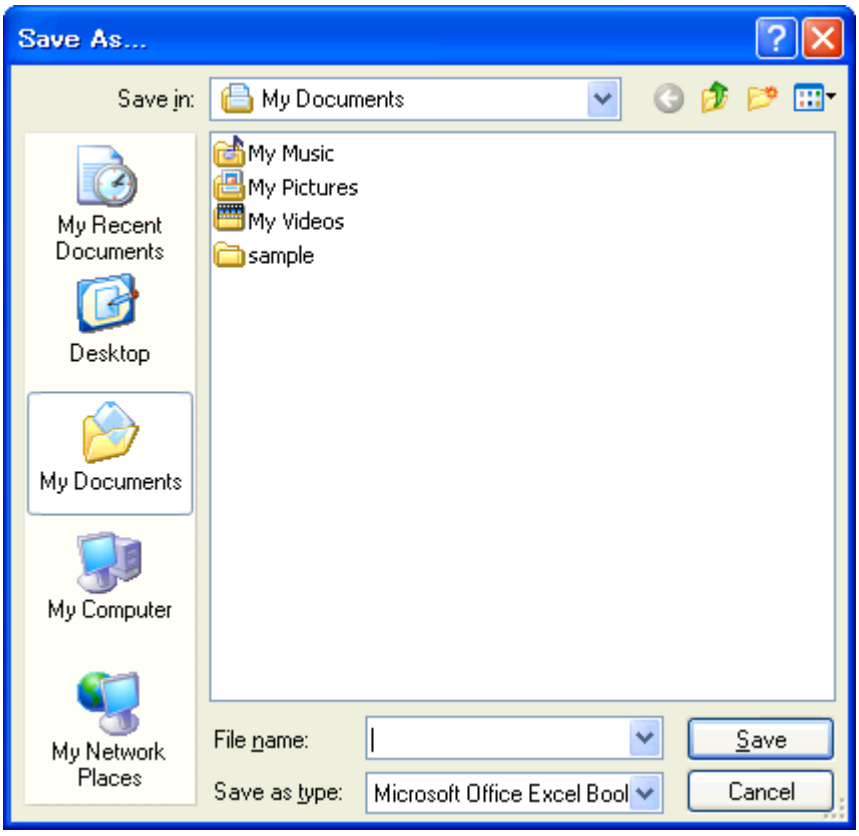
Output report files (files containing information configured using the Pin Configurator: device pin list and device top view) to the specified folder.

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 the 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].

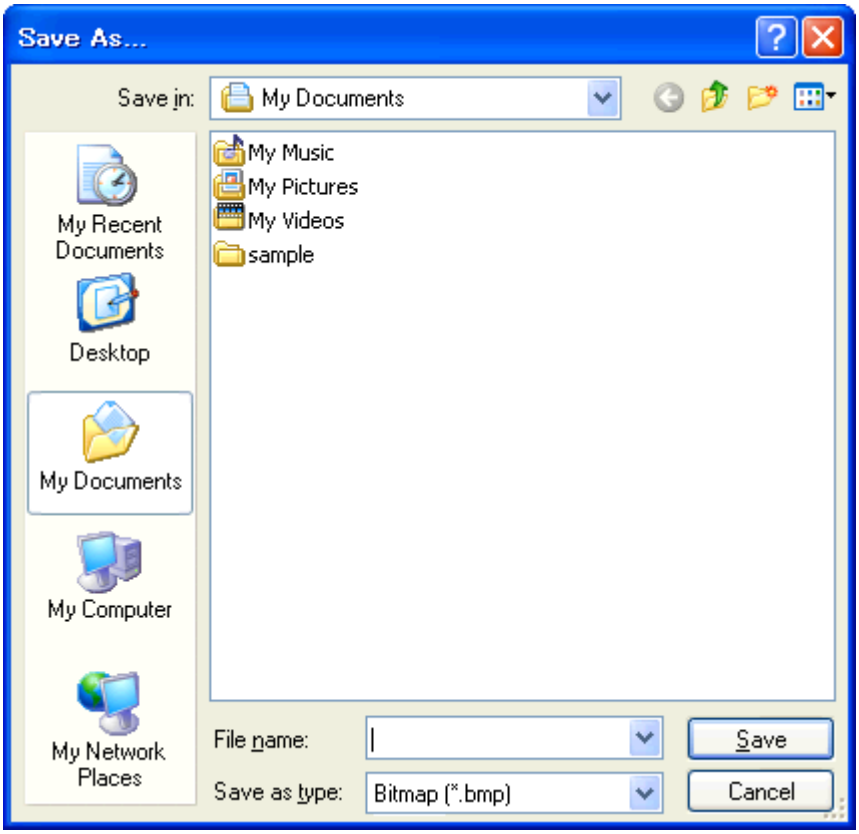
2. The output format for the device pin list is limited to Microsoft Office Excel Book.

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 the 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.

3.1 Overview

The Code Generator outputs source code (device driver programs) based on information selected/entered on the CubeSuite panels that is needed to control peripheral functions provided by the microcontroller (e.g. clock generators, external bus interfaces, and ports).

The following sections describe the operation procedures for the Code Generator.

(1) Start CubeSuite

Launch CubeSuite from the [Start] menu of Windows.

Remark See "CubeSuite Start User's Manual" 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 Start User's Manual" for details on "Create/Open project".

(3) Open Code Generator Panel

Open the Code Generator panel used to configure the information necessary to control the peripheral functions (clock generators, ports, external bus interfaces, etc.).

(4) Enter Information

Allows you to configure the information necessary to control the peripheral functions in the Code Generator panel.

(5) Confirm Source Code

Allows you to confirm the source code (device driver program) that reflects the information configured in the Code Generator 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 the Code Generator and a file containing information regarding the source code) to the specified folder.

(8) Save project

Save a project.

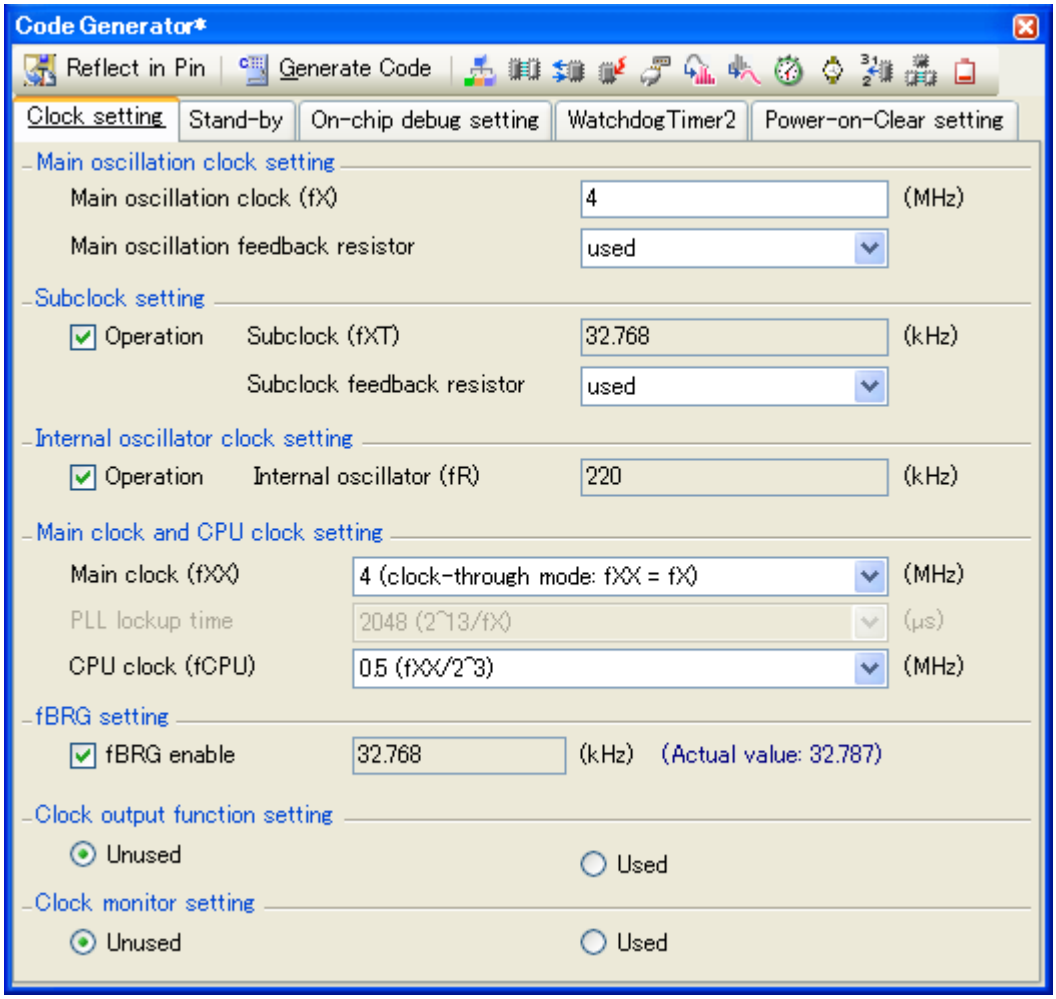
Remark See "CubeSuite Start User's Manual" for details on "Save project".

3.2 Open Code Generator Panel

Open the Code Generator panel to configure the information necessary to control the peripheral functions (clock generators, ports, external bus interfaces, etc.).

To open the Code Generator panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> Peripheral function node ([System], [External Bus], [Port], etc.) in the Project Tree panel.

Figure 3-1. Open Code Generator Panel



Remark If an unsupported microcontroller is defined in the project for the 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 in the information setting area of the Code Generator panel which is opened as described in "3.2 Open Code Generator Panel".

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

3.3.1 Input rule

Following is the rules for input to the Code Generator 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

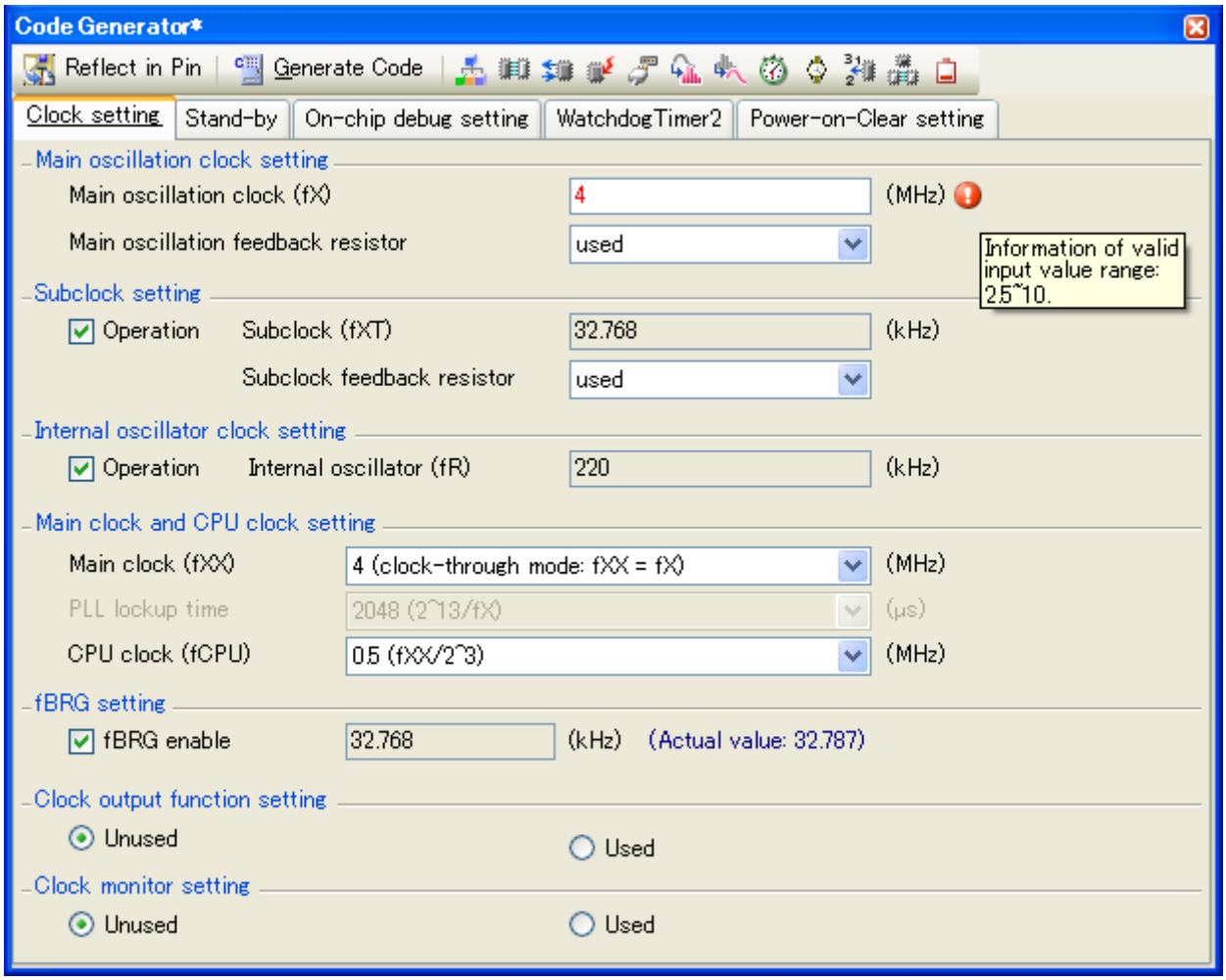
Notation	Outline
Decimal number	A numeric value that starts with a number between 1 and 9 and followed by numbers between 0 and 9, and the numeric value 0
Hex number	A numeric value that starts with 0x and followed by a combination of numbers from 0 to 9 and characters from A to F (characters are not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

3.3.2 Icon indicating incorrect entry

When performing code generation, if you enter an invalid string in the Code Generator 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

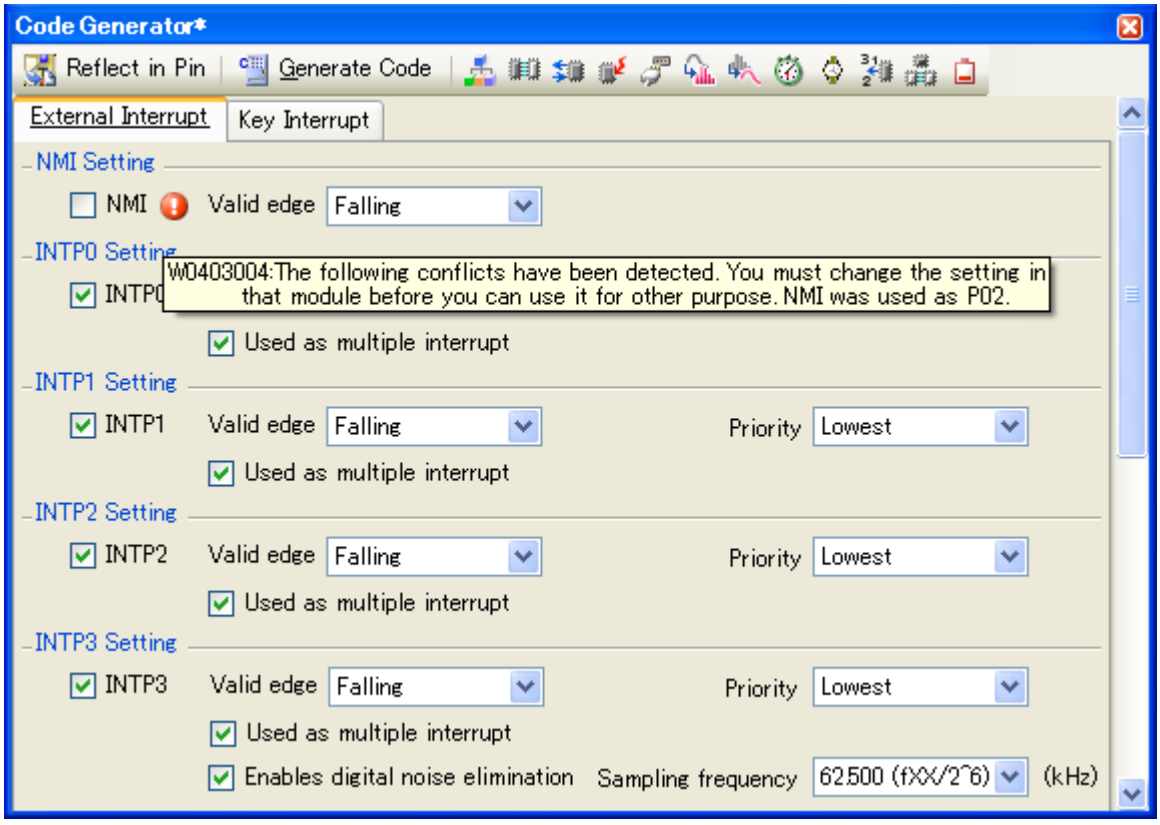


3.3.3 Icon indicating pin conflict

If a conflict occurs between the pins while setting various peripheral functions in the Code Generator 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

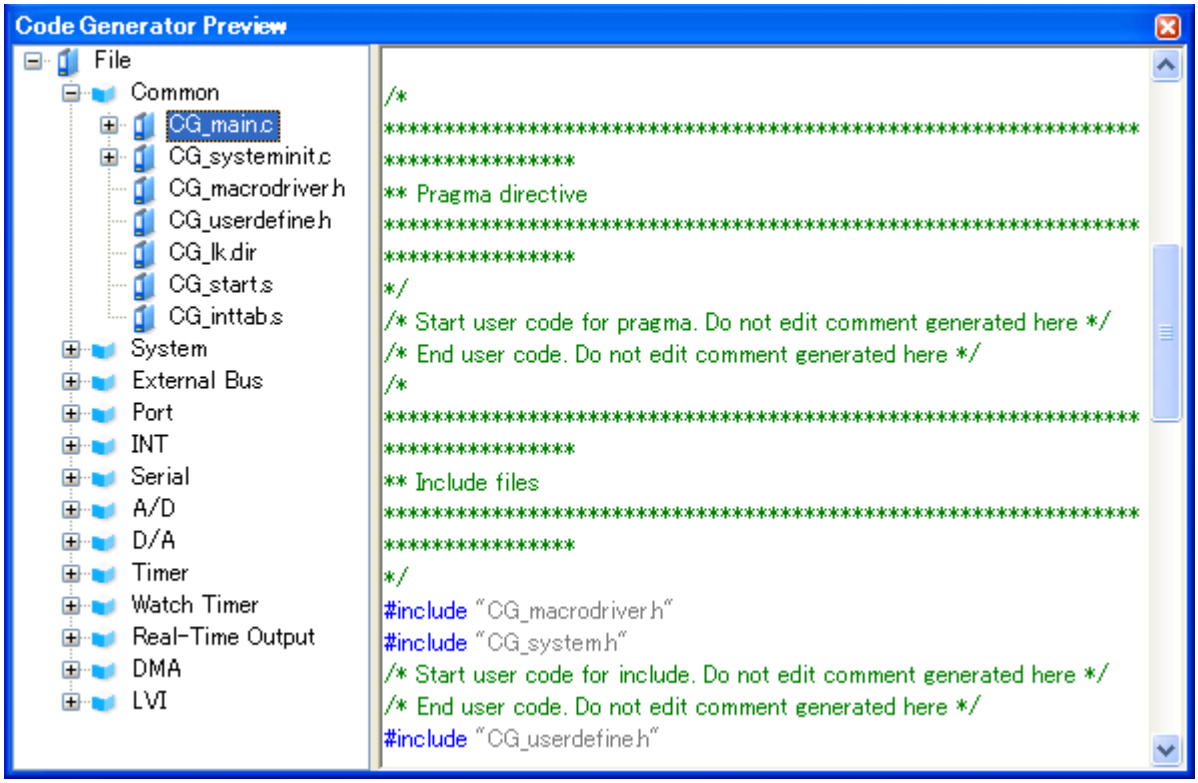


3.4 Confirm Source Code

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 Generator Preview panel that opens by selecting [View] menu >> [Code Generator Preview].

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 Code Generator Preview panel.

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

4. For some of the API functions (such as API functions for serial array units), values such as the SFR register value are calculated and finalized when the source code is generated (when the Generate Code button on the Code Generator panel is pressed). For this reason, the source

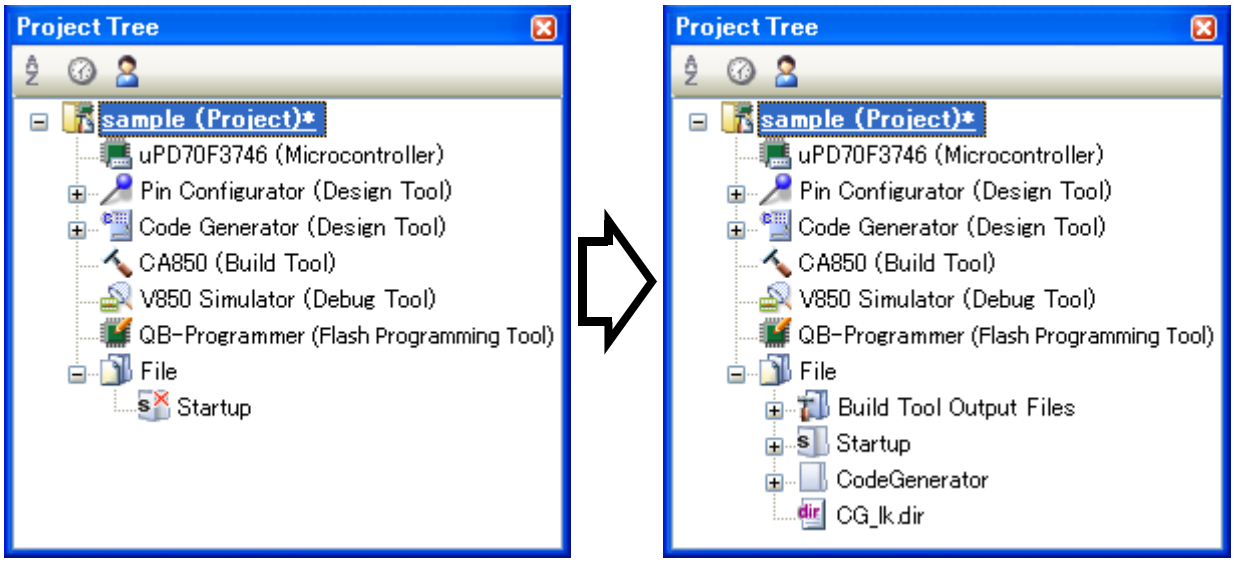
code displayed in the Code Generator Preview panel may not be the same as that would actually be generated.

3.5 Output Source Code

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

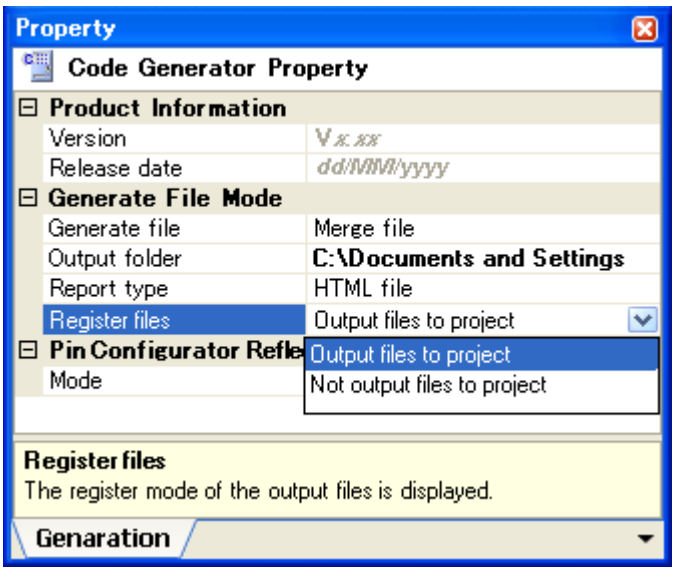
The destination folder for the source code is specified by clicking [Generation] tab >> [Output folder] in the Property panel.

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 [Generation] tab >> [Register files], specify "Output files to project".

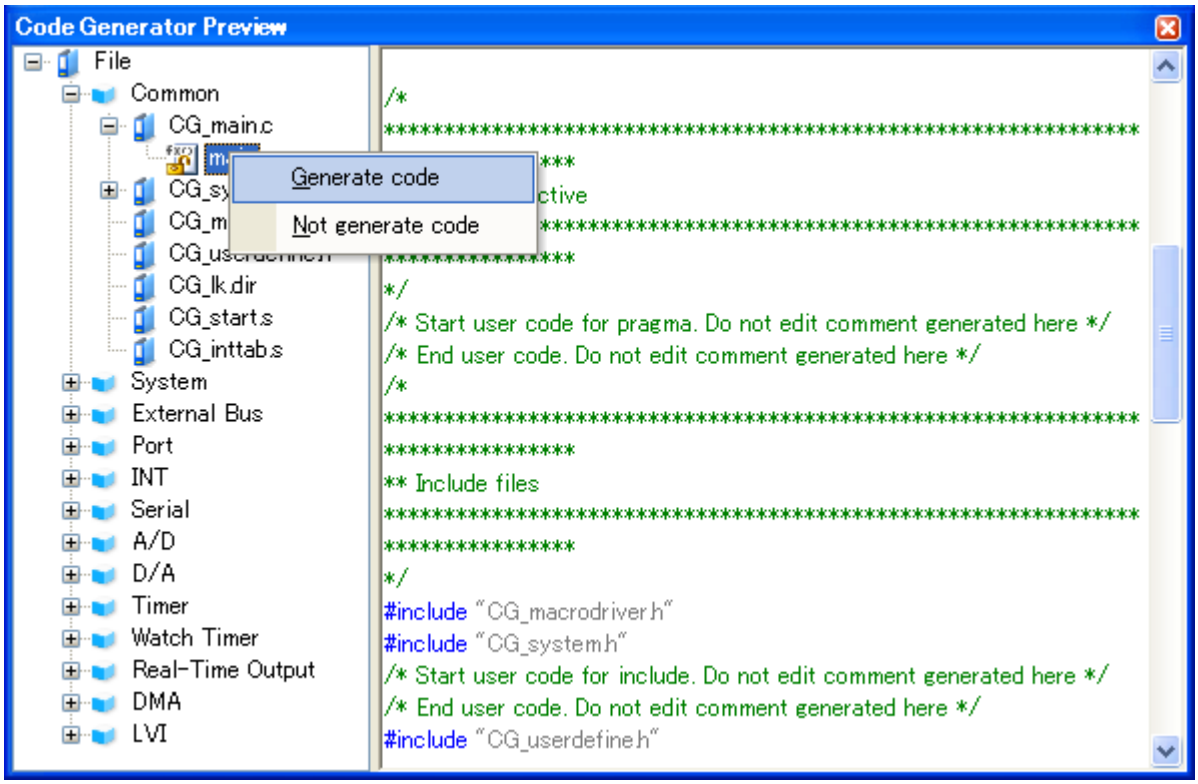
Figure 3-6. Configure Whether to Register



3.5.1 Setting that determines whether or not to generate source code

You can set whether or not to generate the corresponding source code on a per-API function basis by selecting [Generate code/Not generate code] from the context menu displayed by right clicking the API function name in the Code Generator Preview panel.

Figure 3-7. Setting That Determines Whether or Not to Generate Source Code



Remark You can confirm the current setting for the generation of source code by checking the type of icon in the Code Generator Preview panel.

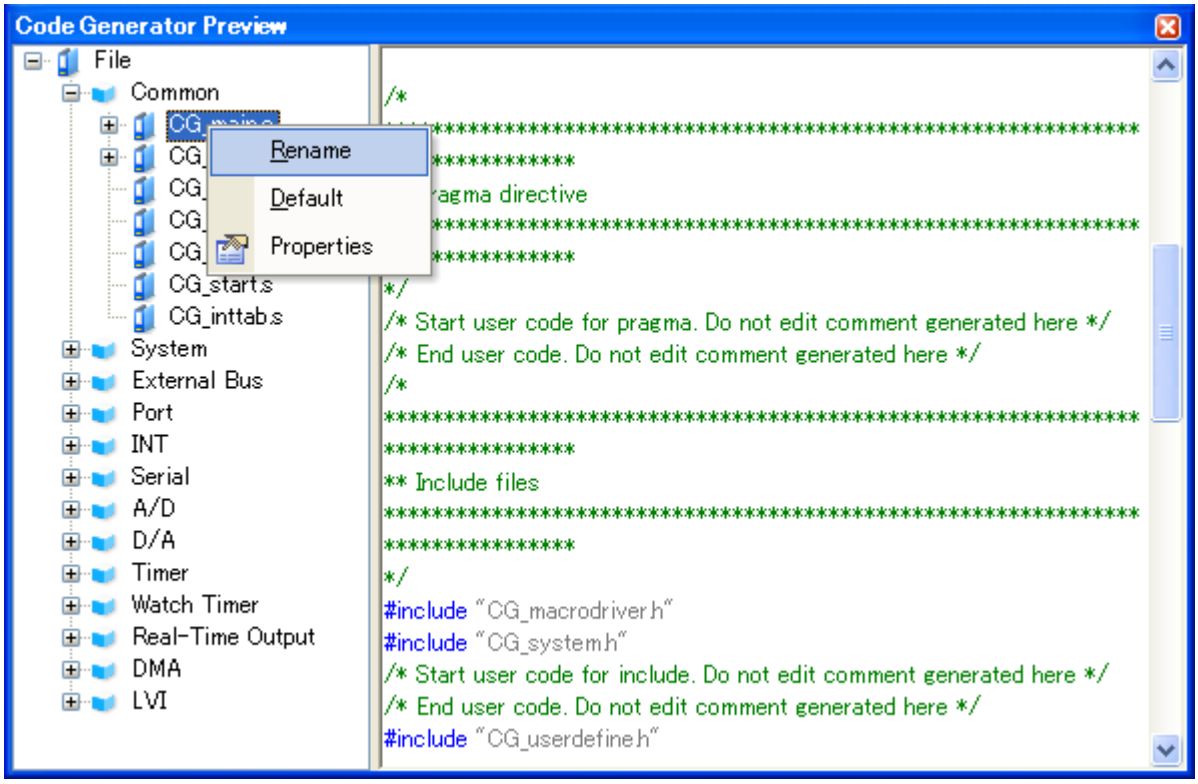
Table 3-4. Setting That Determines Whether or Not to Generate Source Code

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

The Code Generator is used to change the file name by selecting [Rename] from the context menu displayed by right clicking the file name in the Code Generator Preview panel.

Figure 3-8. Change File Name

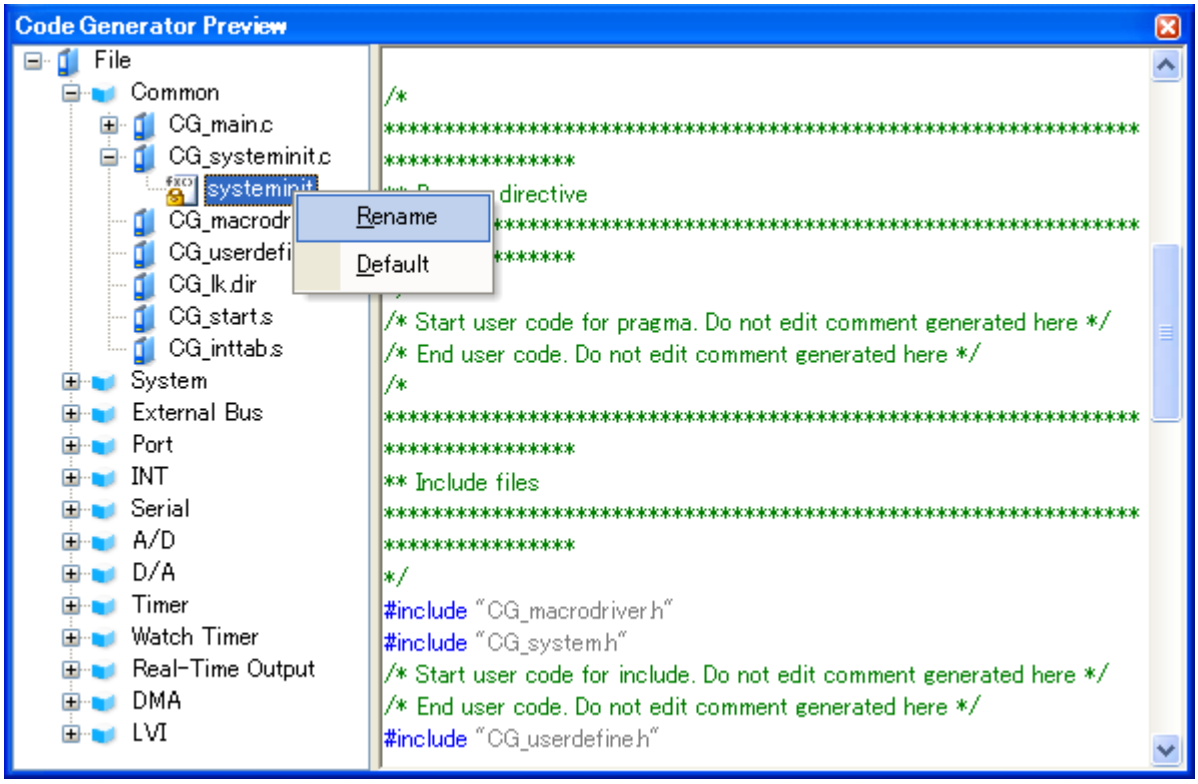


Remark To restore the default file name defined by the Code Generator, select [Default] from the context menu.

3.5.3 Change API function name

The Code Generator is used to change the name of the API function by selecting [Rename] from the context menu displayed by right clicking the API function name in the Code Generator Preview panel.

Figure 3-9. Change API Function Name

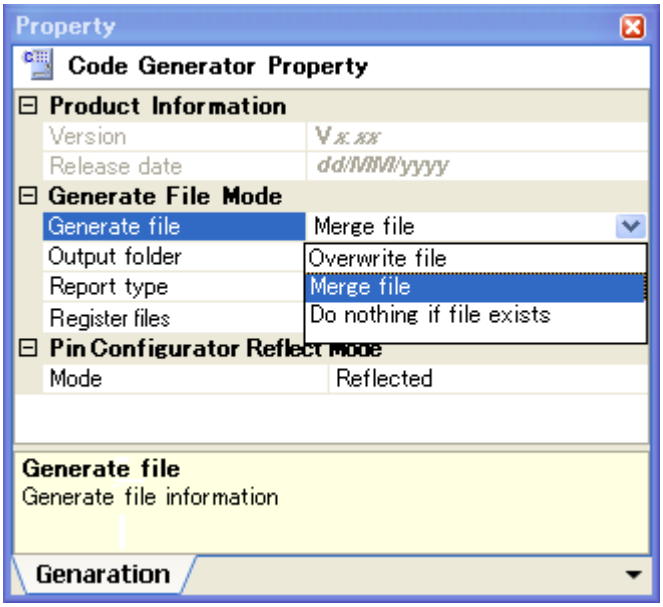


Remark To restore the default name of the API function defined by the Code Generator, select [Default] from the context menu.

3.5.4 Change output mode

The Code Generator is used to change the output mode (Overwrite file, Merge file, Keep file) for the source code by selecting [Generation] tab >> [Generate file] in the Property panel.

Figure 3-10. Change Output Mode



Remark The output mode is selected from the following three types.

Table 3-5. Output Mode of Source Code

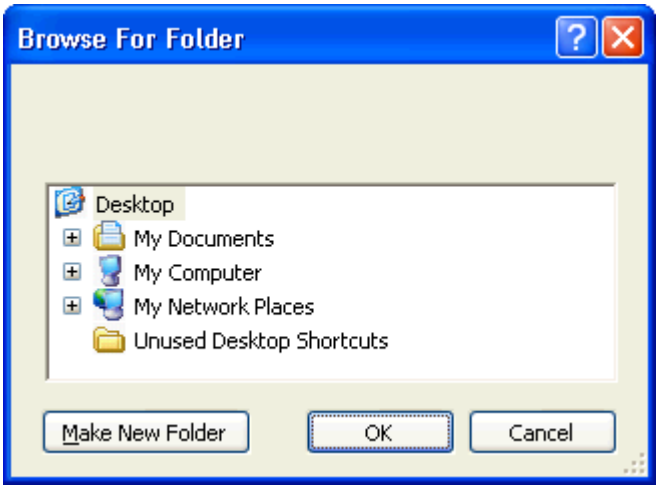
Output Mode	Outline
Overwrite file	If a file with the same name exists, the existing file is overwritten by a new file.
Merge file	If a file with the same name exists, a new file is merged with the existing file. Only the section between "/* Start user code ... . Do not edit comment generated here */" and "/* End user code. Do not edit comment generated here */" will be merged.
Do nothin if file exists	If a file with the same name exists, a new file will not be output.

3.5.5 Change output destination folder

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

To change the output destination, use the Browse For Folder dialog box which opens by pressing the [...] button in the [Output folder].

Figure 3-11. Change Output Destination Folder



3.6 Output Report Files

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

The destination folder for the report file is specified by clicking [Generation] tab >> [Output folder] in the Property panel.

Remarks 1. You can only use "macro" or "function" as a name of the report file.

Table 3-6. Output Report Files

File Name	Outline
macro	A file that contains the information configured using the Code Generator
function	A file that contains the information regarding the source code

2. The output mode for the report file is fixed to "Overwrite file".

Figure 3-12. Output Example of Report File "macro"

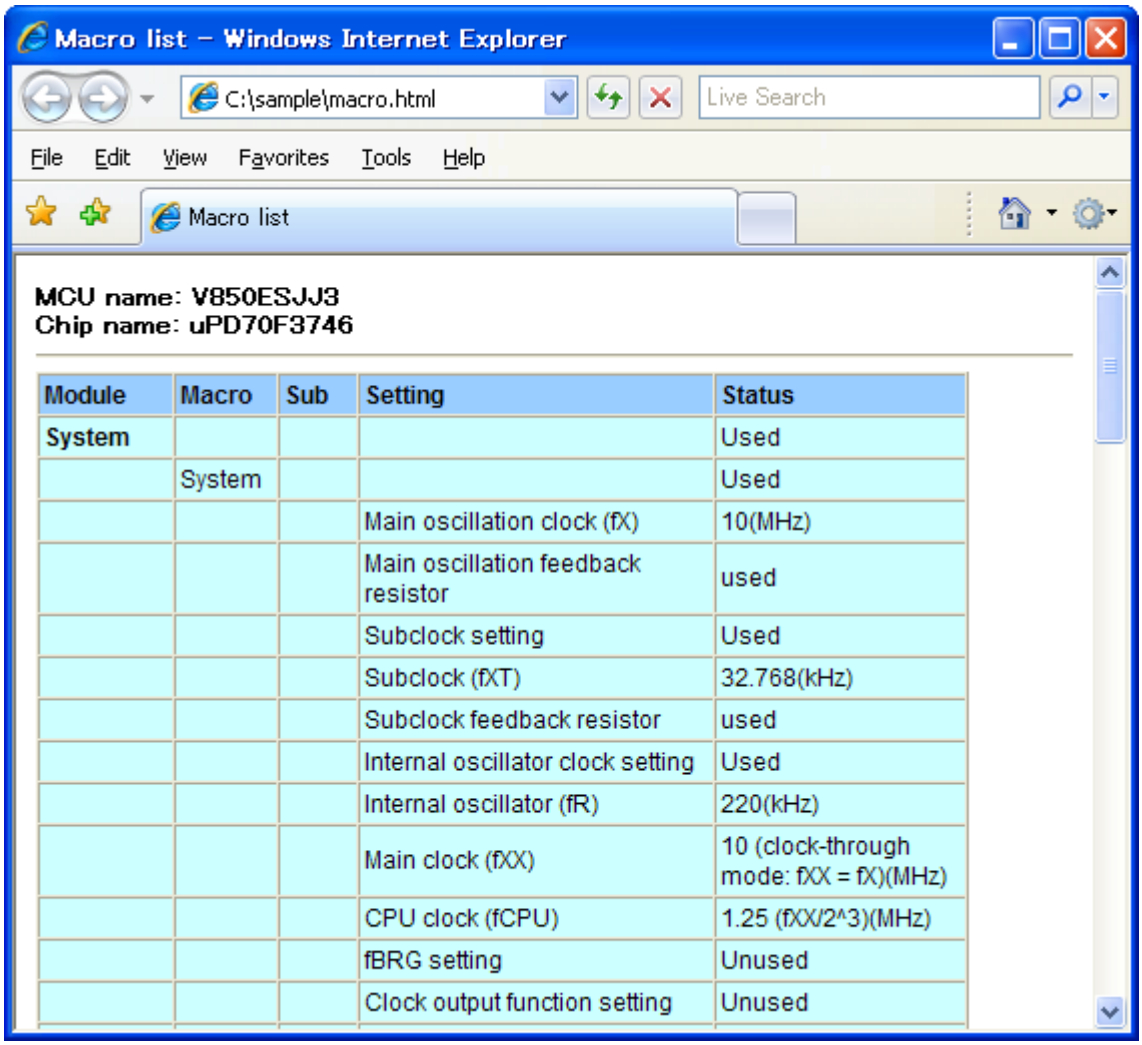
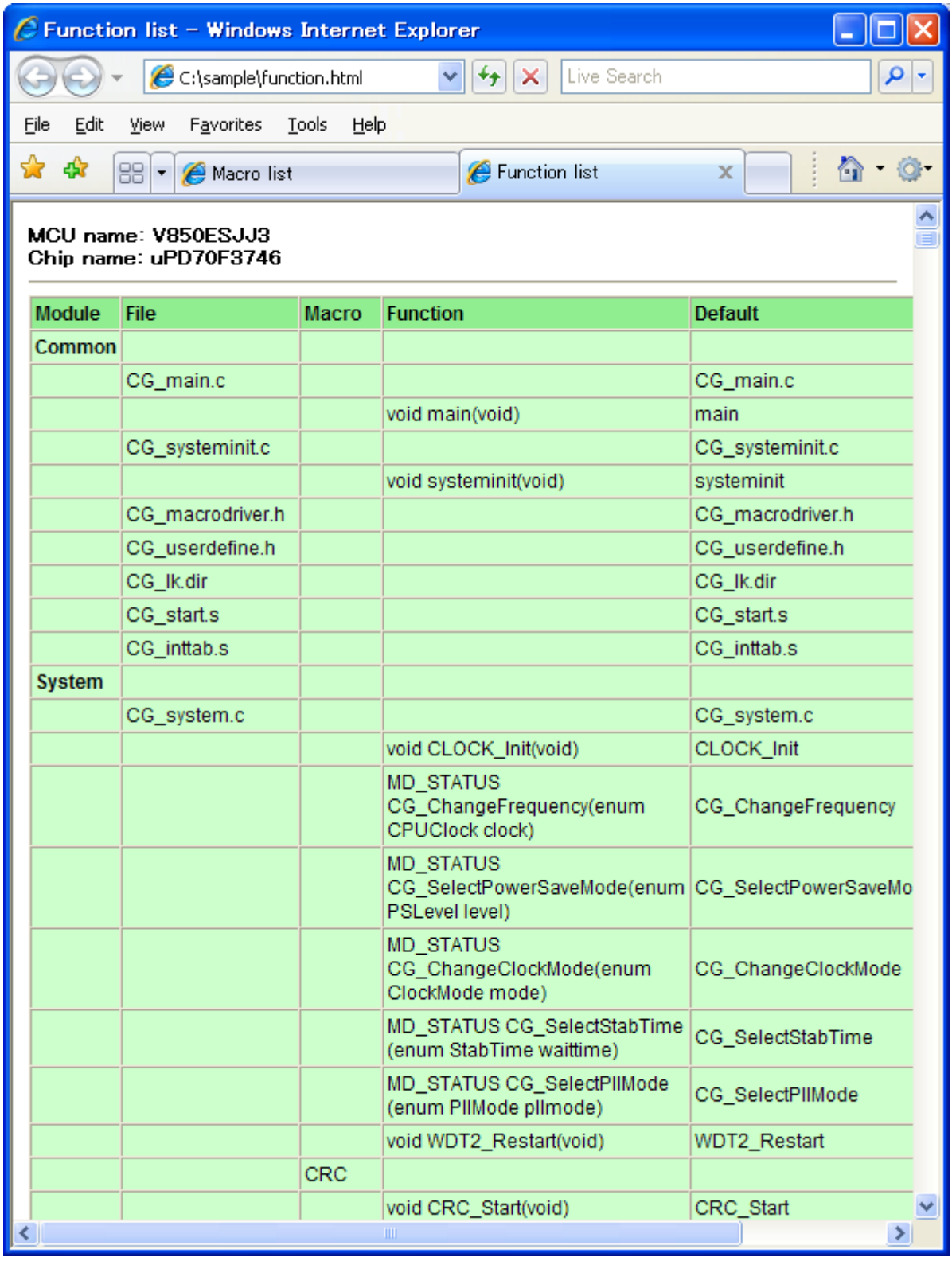


Figure 3-13. Output Example of Report File "function"



Function list – Windows Internet Explorer

C:\sample\function.html

Live Search

File Edit View Favorites Tools Help

Macro list | Function list

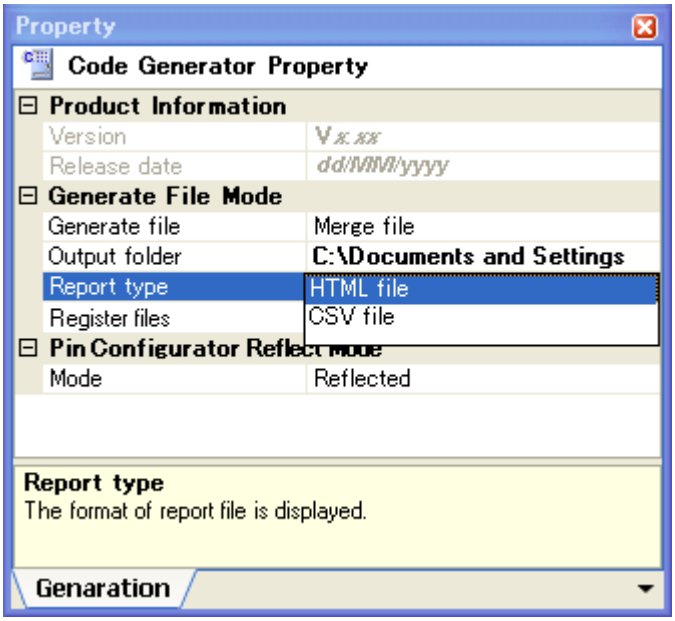
MCU name: V850ESJJ3
Chip name: uPD70F3746

Module	File	Macro	Function	Default
Common				
	CG_main.c			CG_main.c
			void main(void)	main
	CG_systeminit.c			CG_systeminit.c
			void systeminit(void)	systeminit
	CG_macrodriver.h			CG_macrodriver.h
	CG_userdefine.h			CG_userdefine.h
	CG_lk.dir			CG_lk.dir
	CG_start.s			CG_start.s
	CG_inttab.s			CG_inttab.s
System				
	CG_system.c			CG_system.c
			void CLOCK_Init(void)	CLOCK_Init
			MD_STATUS CG_ChangeFrequency(enum CPUClock clock)	CG_ChangeFrequency
			MD_STATUS CG_SelectPowerSaveMode(enum PSLevel level)	CG_SelectPowerSaveMo
			MD_STATUS CG_ChangeClockMode(enum ClockMode mode)	CG_ChangeClockMode
			MD_STATUS CG_SelectStabTime (enum StabTime waittime)	CG_SelectStabTime
			MD_STATUS CG_SelectPllMode (enum PllMode pllmode)	CG_SelectPllMode
			void WDT2_Restart(void)	WDT2_Restart
		CRC		
			void CRC_Start(void)	CRC_Start

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 [Generation] tab >> [Report type] in the Property panel.

Figure 3-14. Change Output Format



Remark Output format is selected from the following two types.

Table 3-7. Output Mode of Source Code

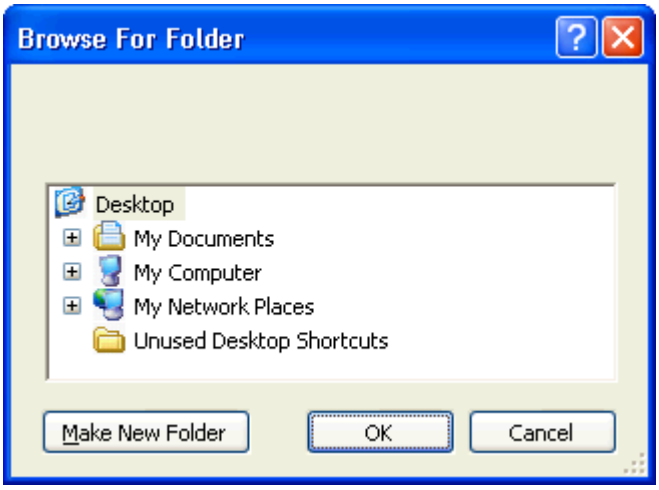
Report Type	Outline
HTML file	Outputs a report file in HTML format.
CSV file	Outputs a report file in CSV format.

3.6.2 Change output destination

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

To change the output destination, use the Browse For Folder dialog box which opens by pressing the [...] button in the [Output folder].

Figure 3-15. Change Output Destination



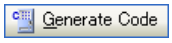
APPENDIX A WINDOW REFERENCE

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.

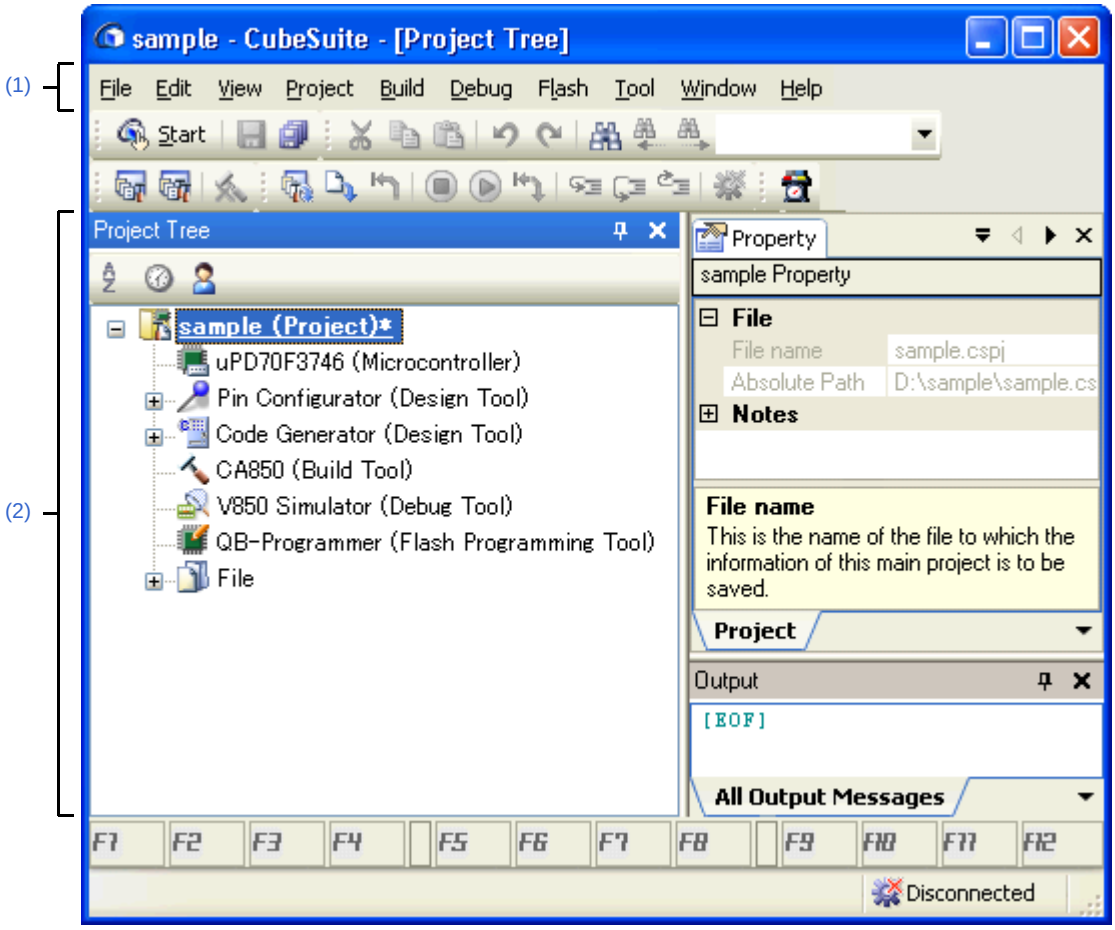
Table A-1. Window/Panel/Dialog Box List

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 and change the setting for the node selected in the Project Tree panel, the peripheral function button pressed in the Code Generator panel or the file selected in the Code Generator Preview 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.
Code Generator panel	This panel allows you to configure the information necessary to control the peripheral functions provided by the microcontroller.
Code Generator Preview panel	This panel allows you to confirm or configure on a per-API function basis the setting that determines whether or not the source code (device driver program) is generated when the  button is pressed in the Code Generator panel. It also allows you to confirm the source code that reflects the information configured in the Code Generator 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.
Browse For Folder dialog box	This dialog box allows you to specify the output destination for files (source code, report file, etc.).
Save As dialog box	This dialog box allows you to name and save a file (such as a report 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] >> [NEC 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 the 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 the Pin Configurator: device pin list).
Save Top View	Device Top View panel-dedicated item Saves a report file (a file containing information configured using the 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 the Pin Configurator: device top view).
Save Code Generator Report	Code Generator panel/Code Generator Preview panel-dedicated item Outputs report files (a file containing information configured using the Code Generator and a file containing information regarding the source code). - The output format for the report file (either HTML or CSV) is selected by clicking [Generation] tab >> [Report type] in the Property panel. - The destination folder for the report file is specified by clicking [Generation] tab >> [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 Generator 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) [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	Code Generator panel-dedicated item Displays the help of Code Generator panel.
Open Help for Code Generator Preview Panel	Code Generator Preview panel-dedicated item Displays the help of Code Generator 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.

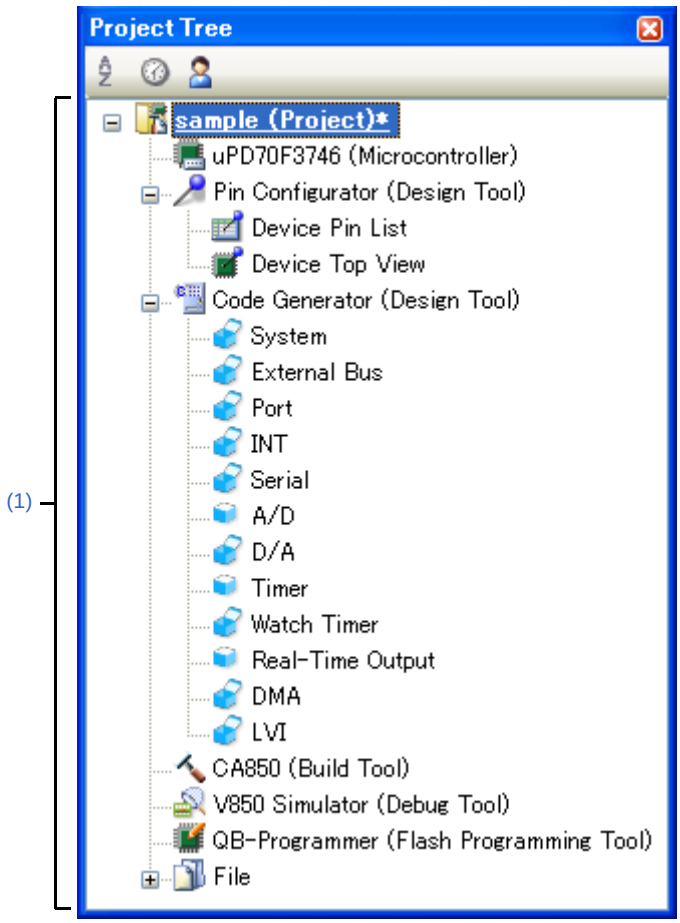
See the following sections for details on this area.

- Project Tree panel
- Property panel
- Device Pin List panel
- Device Top View panel
- Code Generator panel
- Code Generator 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]
- [[Help] menu (Project Tree panel-dedicated items)]
- [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)

This node consists of the following peripheral function nodes.

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

System	Opens the [System] for configuring the information necessary to control the functions of clock generator, on-chip debug function and functions of power-on-clear circuit provided by the microcontroller.
External Bus	Opens the [External Bus] for configuring the information necessary to control the functions of external bus interface (functions to connect an external bus to the area other than the built-in ROM, RAM or SFR) provided by the microcontroller.
Port	Opens the [Port] for configuring the information necessary to control the port functions provided by the microcontroller.
INT	Opens the [INT] for configuring the information necessary to control the interrupt functions and the key interrupt function provided by the microcontroller.
Serial	Opens the [Serial] for configuring the information necessary to control the functions of serial array unit and functions of serial interface provided by the microcontroller.
A/D	Opens the [A/D] for configuring the information necessary to control the function of A/D converter provided by the microcontroller.
D/A	Opens the [D/A] for configuring the information necessary to control the function of D/A converter provided by the microcontroller.
Timer	Opens the [Timer] for configuring the information necessary to control the functions of timer array unit provided by the microcontroller.
Watch Timer	Opens the [Watch Timer] for configuring the information necessary to control the functions of watch timer provided by the microcontroller.
RTC	Opens the [RTC] for configuring the information necessary to control the functions of real-time counter provided by the microcontroller.
Real-Time Output	Opens the [Real-Time Output] for configuring the information necessary to control the real-time output functions provided by the microcontroller.
DMA	Opens the [DMA] for configuring the information necessary to control the functions of DMA (Direct Memory Access) controller provided by the microcontroller.
LVI	Opens the [LVI] for configuring the information necessary to control the functions of low-voltage detector provided by the microcontroller.

(c) Icons

The table below displays the meaning of the icon displayed to the left of the string representing the peripheral function node.

	Operation in the corresponding Code Generator panel has been carried out.

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

[[Help] menu (Project Tree panel-dedicated items)]

Open Help for Project Tree Panel	Displays the help of this panel.

[Context menu]

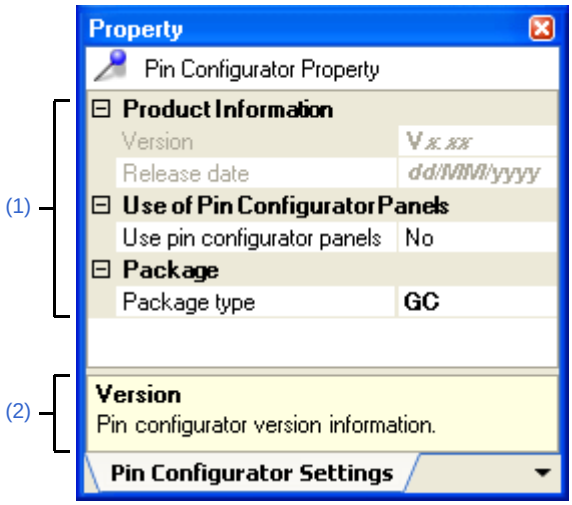
The following context menu items are displayed by right clicking the mouse.

Return to Reset Value	Restores the information for the selected peripheral function node to its default state.
Property	Opens the Property panel containing the information for the selected node ([Pin Configurator (Design Tool)] or [Code Generator (Design Tool)]).

Property panel

This panel allows you to view the information on and change the setting for the node selected in the Project Tree panel, the peripheral function button pressed in the Code Generator panel or the file selected in the Code Generator Preview panel.

Figure A-3. Property Panel (Selected [Pin Configurator (Design Tool)])



The following items are explained here.

- [How to open]
- [Description of each area]
- [[Edit] menu (Property panel-dedicated items)]
- [[Help] menu (Property panel-dedicated items)]
- [Context menu]

[How to open]

- On the Project Tree panel, select a node ([Pin Configurator (Design Tool)], [Device Pin List], [Device Top View], [Code Generator (Design Tool)], peripheral function node "[System], [External Bus], [Port], etc."), and then select [Property] from the [View] menu.
- On the Project Tree panel, select a node ([Pin Configurator (Design Tool)], [Device Pin List], [Device Top View], [Code Generator (Design Tool)], peripheral function node "[System], [External Bus], [Port], etc."), and then select [Property] from the context menu.
- On the Code Generator Preview panel, select a file, and then select [Property] from the [View] menu.
- On the Code Generator Preview panel, select a file, and then select [Property] from the context menu.

Remarks 1. If this panel is already open, selecting a different node ([Pin Configurator (Design Tool)], [Device Pin List], [Device Top View], [Code Generator (Design Tool)] or peripheral function node such as [System], [External Bus] or [Port]) in the Project Tree panel changes the content displayed in the Detail information display/change area and Explanation area accordingly.

2. If this panel is already open, pressing a different peripheral function button (such as , or) in the Code Generator panel changes the content displayed in the Detail information display/change area and Explanation area accordingly.

3. If this panel is already open, selecting a different file in the Code Generator Preview panel changes the content displayed in the Detail information display/change area and Explanation area accordingly.

[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 ([Pin Configurator (Design Tool)], [Device Pin List], [Device Top View], [Code Generator (Design Tool)] or peripheral function node such as [System], [External Bus] or [Port]) selected in the Project Tree panel, the peripheral function button (such as  ,  or ) pressed in the Code Generator panel, or the file selected in the Code Generator Preview panel.
The content displayed in this area differs depending on the node selected in the Project Tree panel, the peripheral function button pressed in the Code Generator panel or the file selected in the Code Generator Preview 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".

Remarks 1. See the sections "[Pin Configurator Settings] tab", "[Pin Configurator Information] tab", "[Device Top View Settings] tab", "[Generation] tab", "[Macro Setting] tab" and "[File Setting] tab" for details on the content displayed in this area.

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

(2) Explanation area

This area displays a "brief description" of the category or item selected in the Detail information display/change area.

[[Edit] menu (Property panel-dedicated items)]

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.

[[Help] menu (Property panel-dedicated items)]

Open Help for Property Panel	Displays the help of this panel.

[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.

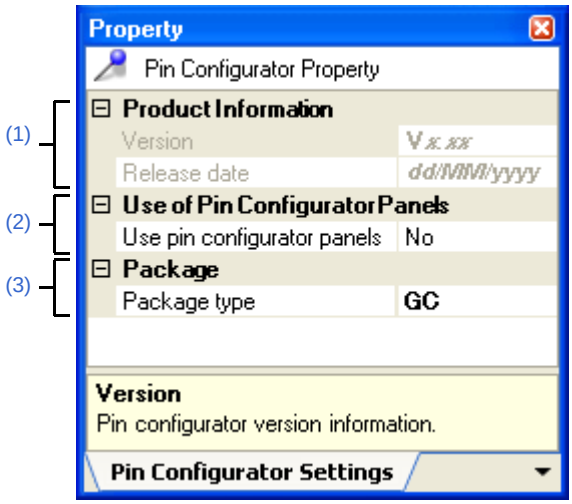
(2) While the item is not being edited

Property Reset to Default	Restores the selected item to its default state.
Property Reset All to Default	Restores all items to their default state.

[Pin Configurator Settings] tab

This tab displays information (Product Information, Use of Pin Configurator 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 the Pin Configurator.

Version	Displays the version of the Pin Configurator.
Release date	Displays the release date of the Pin Configurator.

(2) [Use of Pin Configurator Panels] category

Select whether to show the Device Pin List panel and Device Top View panel.

Use pin configurator panels	Selects whether to display the Device Pin List panel and Device Top View panel in the Main window the next time this project is opened.	
	Yes	Displays the Device Pin List panel and Device Top View panel.
	No	Hides the Device Pin List panel and Device Top View panel.

(3) [Package] category

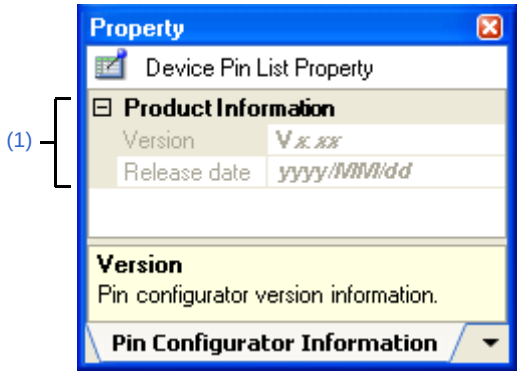
Change the shape (package type) and settings of the microcontroller to display as the device top view in the Device Top View panel.

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

[Pin Configurator Information] tab

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

Figure A-5. [Pin Configurator 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

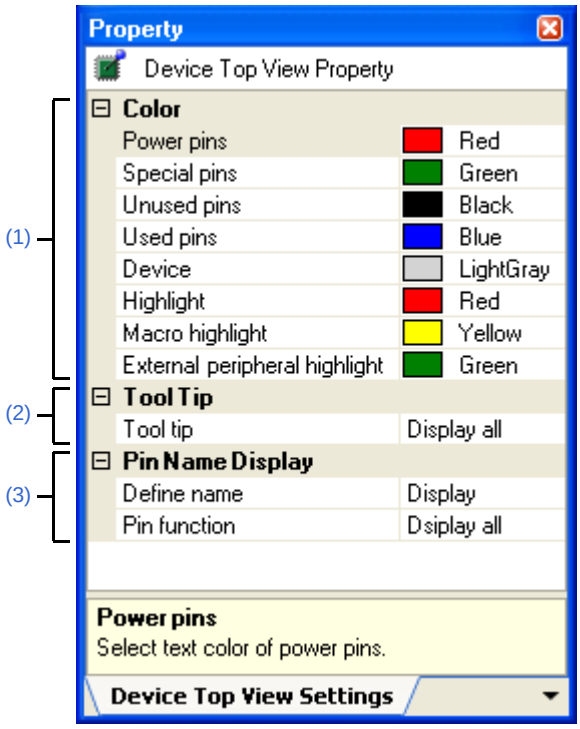
This area displays product information (Version and Release date) on Pin Configurator.

Version	Displays the version of Pin Configurator.
Release date	Displays the release date of Pin Configurator.

[Device Top View Settings] tab

This tab allows you to view the information (Color, Tool Tip and Product Information) 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

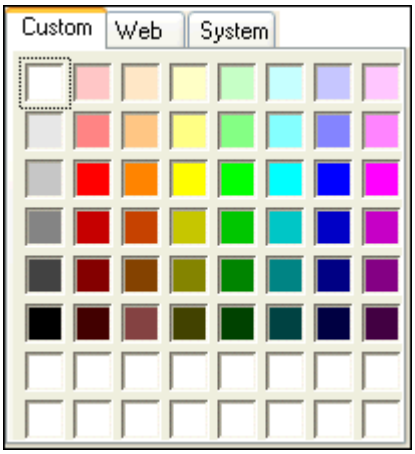
Select the display colors to differentiate the pin groups (power pins, special pins, unused pins, etc.) in the device top view.

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	Selects the background color of a pin selected in the Device Pin List panel, on the [Pin Number] tab.
Macro highlight	Selects the background color of pins selected in the Device Pin List panel, on the [Macro] tab.
External peripheral highlight	Selects the background color of pins selected in the Device Pin List panel, on the [External Peripheral] tab.

Remark To change the setting of the color, use the following color palette which opens by making a selection from the dropdown list in this area.

Figure A-7. Color Palette



(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.	
	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" string 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

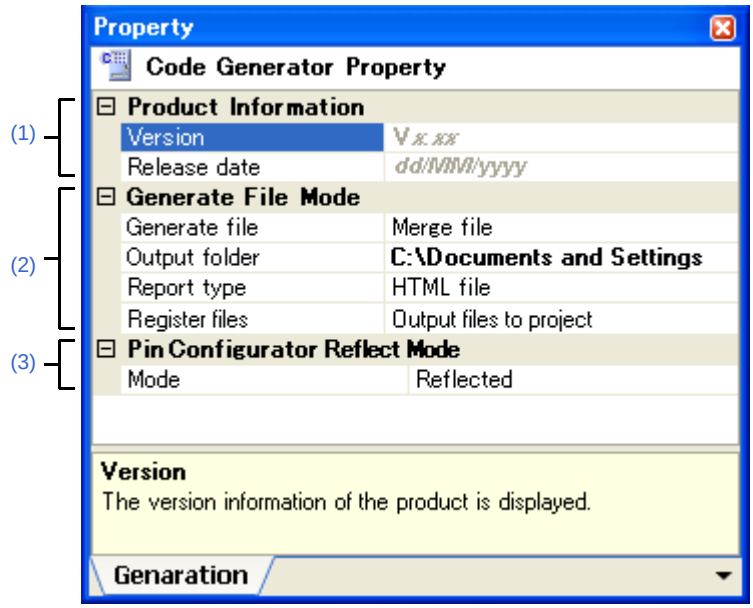
Select whether to display additional information about the pin in the device top view.

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.

[Generation] tab

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

Figure A-8. [Generation] 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) [Product Information] category

This area displays product information (Version and Release date) on the Code Generator.

Version	Displays the version of the Code Generator.
Release date	Displays the release date of the Code Generator.

(2) [Generate File Mode] category

This area allows you to view and change the setting for the file generation mode (Generate file, Report type, Output folder and Register files) of the Code Generator.

Generate file	Views or select the operation mode applied when the Generate Code button is pressed. Operation mode applied when you select [File] menu >> [Save Code Generator Report] is fixed to "Overwrite file".	
	Overwrite file	If a file with the same name exists, the existing file is overwritten by a new file.
	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.
	Do nothing if file exists	If a file with the same name exists, a new file will not be output.
Output folder	Views or select the destination folder for various files (source code and report files) which are output when the Generate Code button is pressed or when [File] menu >> [Save Code Generator Report] is selected.	
Report type	Views or select the format of the report files (a file containing information configured using the Code Generator and a file containing information regarding the source code) which are output when [File] menu >> [Save Code Generator Report] is selected.	
	HTML file	Outputs a report file in HTML format.
	CSV file	Outputs a report file in CSV format.
Register files	Selects whether source code generated by pressing the Generate Code button should be added to the project.	
	Output files to project	Adds output source code to the project. The source code will be added to the Project Tree panel, under the [File] - [Code Generator] node.
	Not output files to project	Does not add output source code to the project.

Remark To change the output destination, use the Browse For Folder dialog box which opens by pressing the [...] button in this area.

(3) [Pin Configurator Reflect Mode] category

Configure the information linking (mode) between the Code Generator and Pin Configurator.

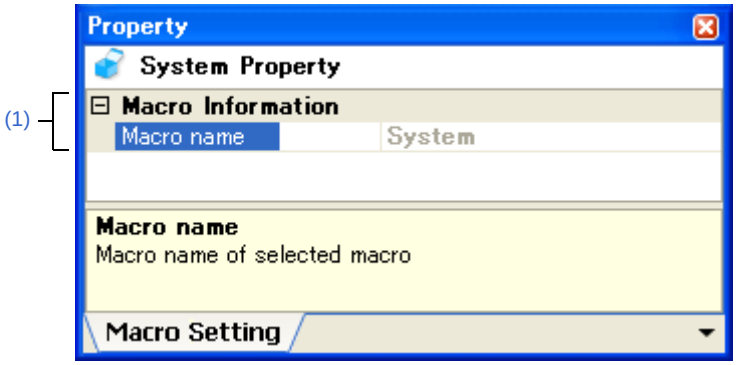
Mode	Selects whether to reflect the settings made in the Code Generator panel in the Device Pin List panel when the Reflect in Pin button is pressed.	
	Reflected	Reflects Code Generator panel settings in the Device Pin List panel.
	Not reflected	Does not reflect Code Generator panel settings in the Device Pin List panel.

Remark If "Not reflected" is selected, then the Reflect in Pin button will be grayed out (deselected).

[Macro Setting] tab

This tab allows you to view the information (Macro Information) on and change the setting for the peripheral function node such as [System], [External Bus] or [Port] selected in the Project Tree panel, or the peripheral function button (such as  ,  or ) pressed in the Code Generator panel.

Figure A-9. [Macro 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)] >> Peripheral function node "[System], [External Bus], [Port], etc.", and then select [Property] from the [View] menu.
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> Peripheral function node "[System], [External Bus], [Port], etc.", and then select [Property] from the context menu.

Remarks 1. If this panel is already open, selecting a different peripheral function node such as [System], [External Bus] or [Port] in the Project Tree panel changes the content displayed accordingly.

2. If this panel is already open, pressing a different type of peripheral function button (such as  ,  or ) in the Code Generator panel changes the content displayed accordingly.

[Description of each area]

(1) [Macro Information] category

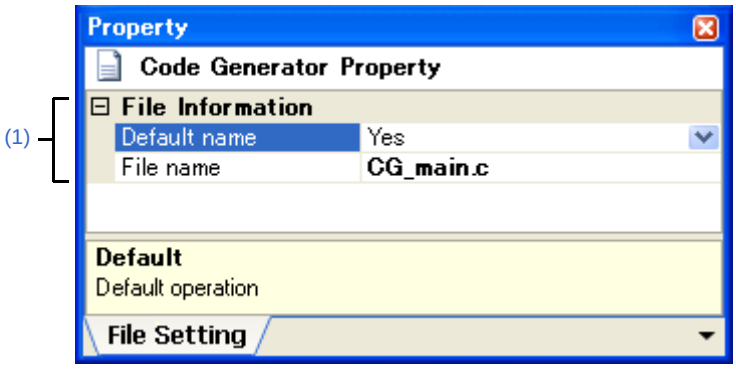
This area allows you to view the information (Macro name) on and change the setting for the peripheral function node such as [System], [External Bus] or [Port] selected in the Project Tree panel, or the peripheral function button pressed in the Code Generator panel.

Macro name	Displays the type of peripheral function node selected in the Project Tree panel or the type of peripheral function button pressed in the Code Generator panel.

[File Setting] tab

This tab allows you to view the information (File Information) on and change the setting for the file selected in the Code Generator Preview panel.

Figure A-10. [File Setting] Tab



The following items are explained here.

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

[How to open]

- On the Code Generator Preview panel, select a file, and then select [Property] from the [View] menu.
- On the Code Generator Preview panel, select a file, and then select [Property] from the context menu.

Remark If this panel is already open, selecting a different file in the Code Generator Preview panel changes the content displayed accordingly.

[Description of each area]

(1) [File Information] category

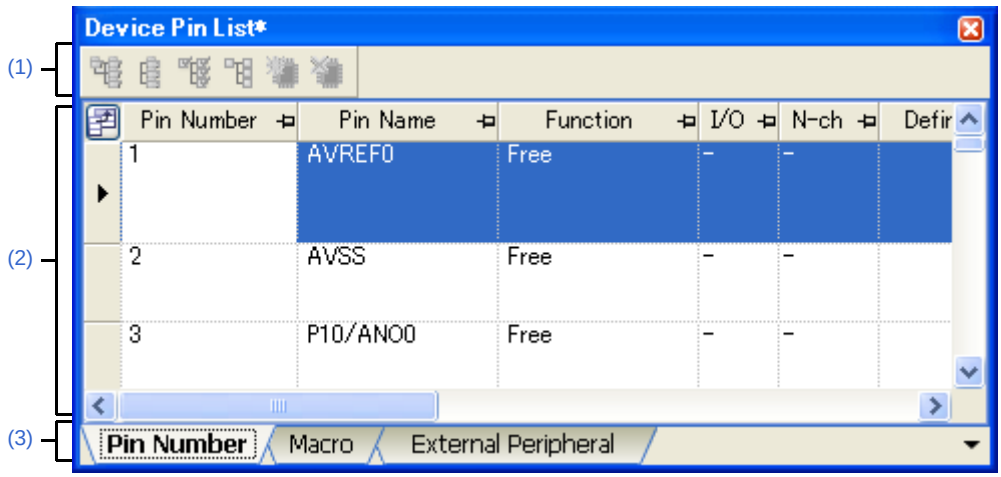
This area allows you to view the information (Default, File name) on and change the setting for the file selected in the Code Generator Preview panel.

Default name	Views or select the setting that determines whether the name of the file selected in the Code Generator Preview panel is a default name or not.	
	Yes	The file name is a default name. Changing this area from "No" to "Yes" changes the name of the file to its default name.
	No	The file name is not a default name.
File name	Displays or change the name of the file selected on the Code Generator Preview panel.	

Device Pin List panel

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

Figure A-11. Device Pin List Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [[File] menu (Device Pin List panel-dedicated items)]
- [[Help] menu (Device Pin List panel-dedicated items)]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Pin Configurator (Design Tool)] >> [Device Pin List].
- 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

Display 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.

[[File] menu (Device Pin List panel-dedicated items)]

Save Pin List	Saves a report file (a file containing information configured using the Pin Configurator: device pin list) overwriting the existing file.
Save Pin List As...	Opens the Save As dialog box for naming and saving a report file (a file containing information configured using the Pin Configurator: device pin list).

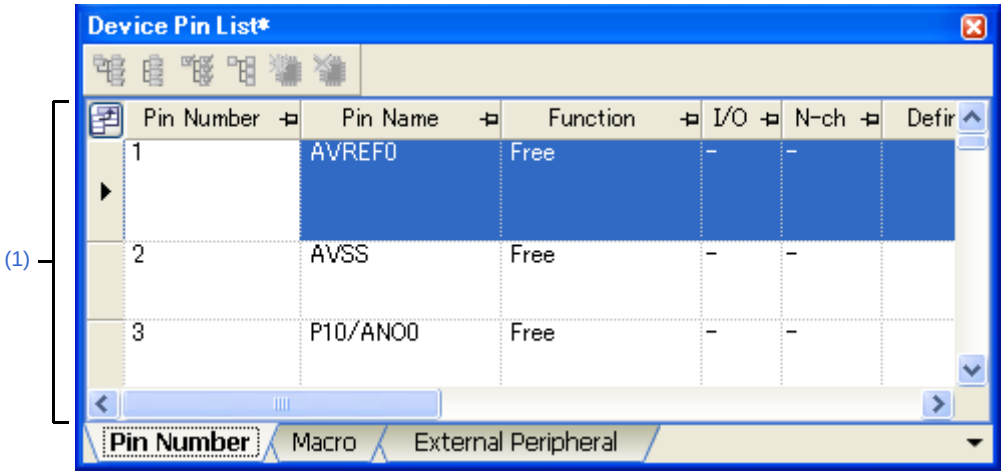
[[Help] menu (Device Pin List panel-dedicated items)]

Open Help for Device Pin List Panel	Displays the help of this panel.

[Pin Number] tab

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

Figure A-12. [Pin Number] 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].
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Device pin list area

Display 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.
Define Name	This area allows you to assign a "user-defined pin name" to the pin.
Description	Displays the summary of function of the pin.

Column Heading	Outline
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.

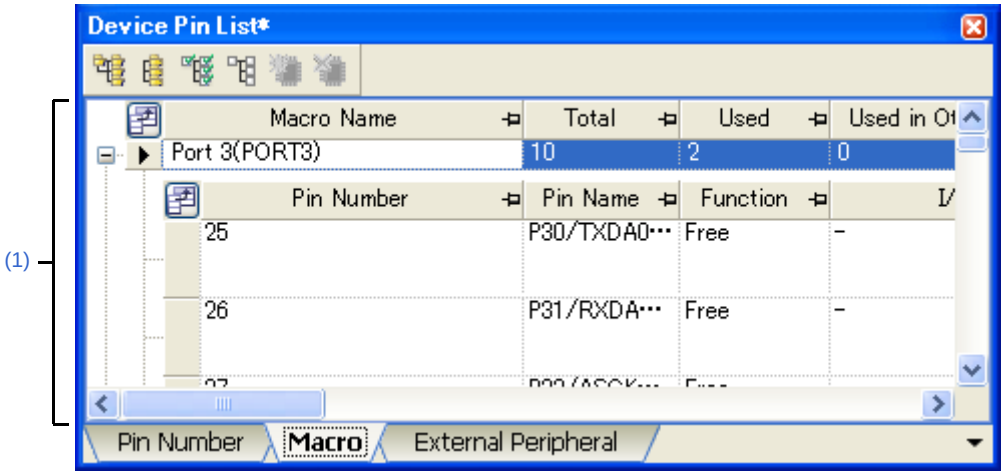
3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

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-13. [Macro] 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].
- 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.
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.

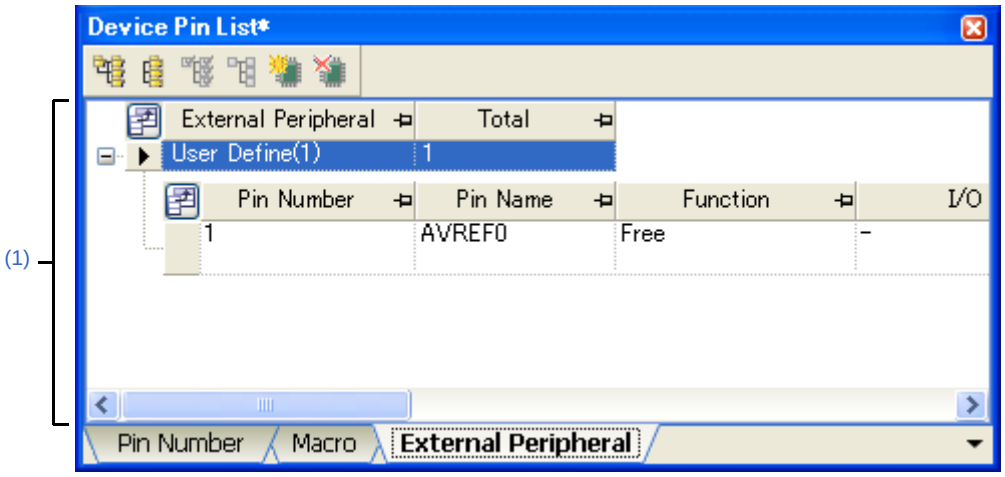
3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

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-14. [External Peripheral] 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].
- From the [View] menu, select [Pin Configurator] >> [Device Pin List].

[Description of each area]

(1) Device pin list area

Display 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.
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.
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.

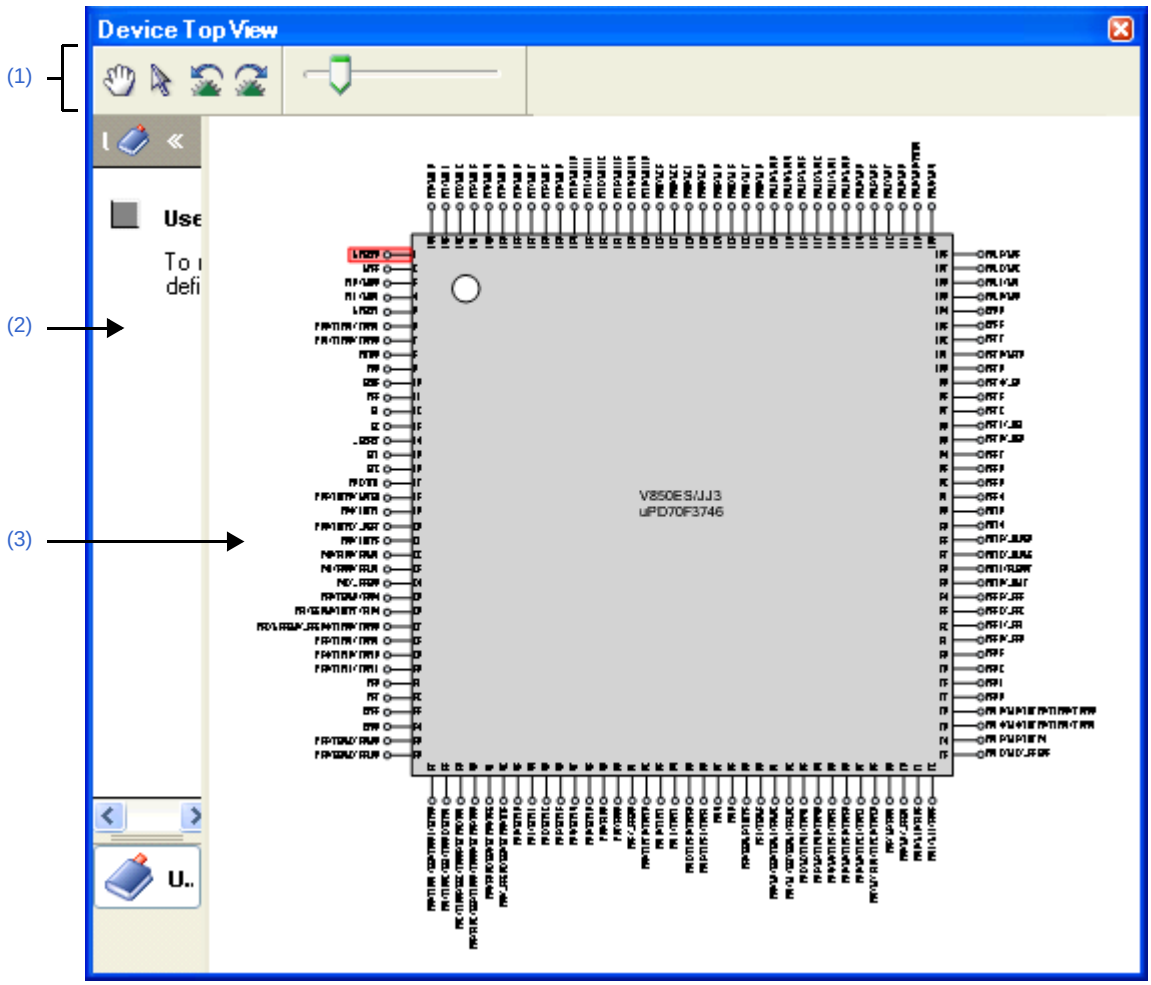
3. To move columns (change the display order) in the device pin list, drag and drop the desired column to the desired location.

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.

Figure A-15. Device Top View Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [[File] menu (Device Top View panel-dedicated items)]
- [[Help] menu (Device Top View panel-dedicated items)]
- [Context menu]

[How to open]

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

Remark In the Property panel, on the [Pin Configurator Settings] tab, if "BGA" is selected for the Package type, 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 theDevice 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.

[[File] menu (Device Top View panel-dedicated items)]

Save Top View	Saves a report file (a file containing information configured using the Pin Configurator: device top view) overwriting the existing file.
Save Top View As...	Opens the Save As dialog box for naming and saving a report file (a file containing information configured using the Pin Configurator: device top view).

[[Help] menu (Device Top View panel-dedicated items)]

Open Help for Device Top View Panel	Displays the help of this panel.

[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.

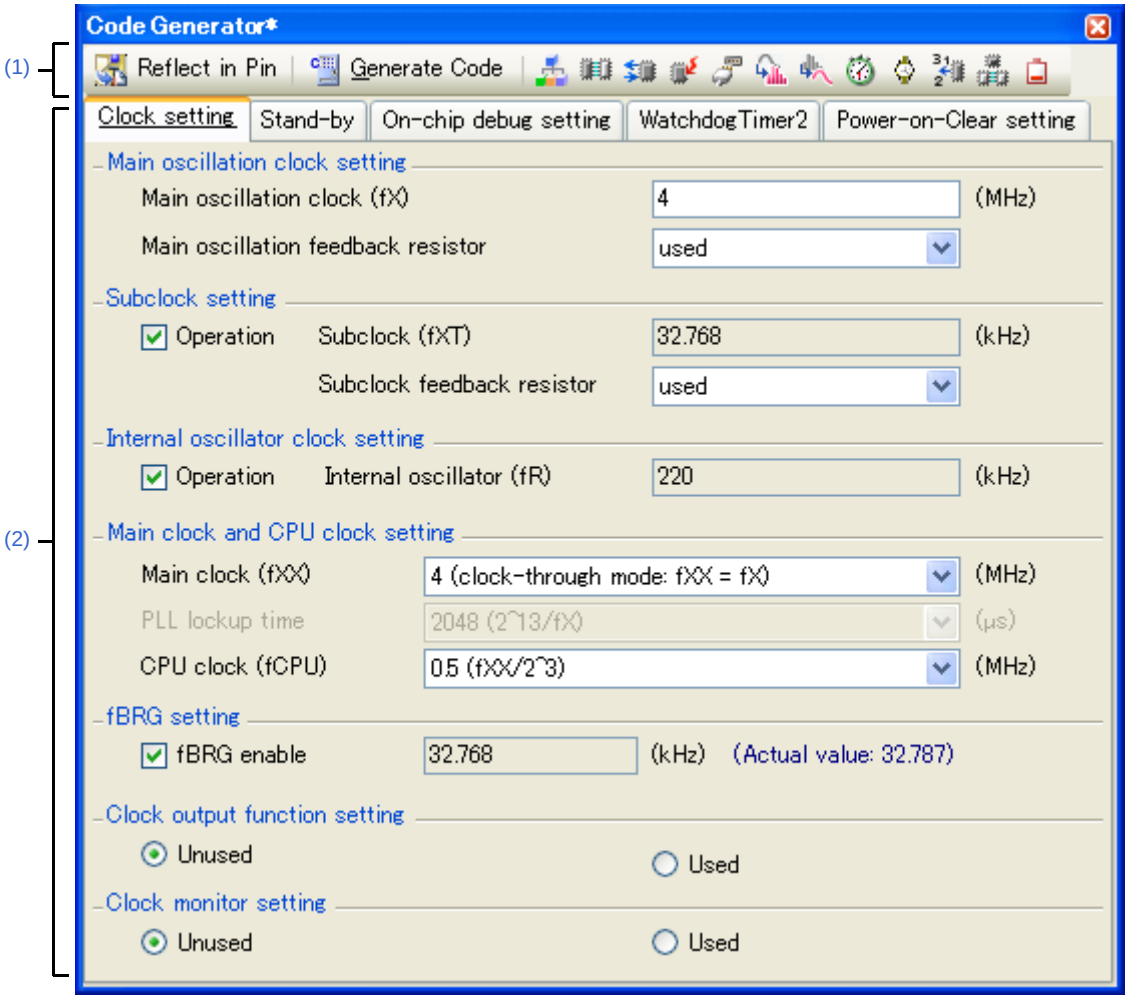
(2) When an external peripheral controller is right clicked

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

Code Generator panel

This panel allows you to configure the information necessary to control the peripheral functions provided by the micro-controller.

Figure A-16. Code Generator Panel: [System]



The following items are explained here.

- [How to open]
- [Description of each area]
- [[File] menu (Code Generator panel-dedicated items)]
- [[Help] menu (Code Generator panel-dedicated items)]

[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> Peripheral function node ([System], [External Bus], [Port], etc.).

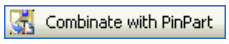
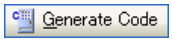
Remark If this panel is already open, pressing a different peripheral function button (such as , or) changes the content displayed in the Information setting area accordingly.

[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.

	Reflects settings made on this panel in the Device Pin List panel. This button will be grayed out (disabled) if the "Not reflected" is selected in the [PinPart Combination Mode] category of the [Generation] tab.
	Outputs the source code (device driver program) to the folder specified by selecting [Generation] tab >> [Output folder] in the Property panel.
	Changes the view in the Information setting area to [System] in order to configure the information required to control the clock generation function, standby function, and etc. provided by the microcontroller.
	Changes the view in the Information setting area to [External Bus] in order to configure the information required to control the external bus interface mode control function (function for connecting to external memory areas) provided by the microcontroller.
	Changes the content displayed in the Information setting area to the "[Port] for configuring the information necessary to control the port functions provided by the microcontroller".
	Changes the content displayed in the Information setting area to the "[INT] for configuring the information necessary to control the external interrupt functions and the key interrupt function provided by the microcontroller".
	Changes the view in the Information setting area to [Serial] in order to configure the information required to control the asynchronous serial interface A (UARTA), 3-wire variable-length serial I/O (CSIB), and etc. provided by the microcontroller.
	Changes the content displayed in the Information setting area to the "[A/D] for configuring the information necessary to control the function of A/D converter provided by the microcontroller".
	Changes the content displayed in the Information setting area to the "[D/A] for configuring the information necessary to control the function of D/A converter provided by the microcontroller".
	Changes the view in the Information setting area to [Timer] in order to configure the information required to control the 16-bit timer/event counter P (TMP), 16-bit timer/event counter Q (TMQ), and 16-bit interval timer M (TMM) functions provided by the microcontroller.
	Changes the content displayed in the Information setting area to the "[Watch Timer] for configuring the information necessary to control the functions of watchdog timer provided by the microcontroller".
	Changes the content displayed in the Information setting area to the "[RTC] for configuring the information necessary to control the functions of real-time counter provided by the microcontroller".
	Changes the content displayed in the Information setting area to the "[Real-Time Output] for configuring the information necessary to control the functions of real-time counter provided by the microcontroller".
	Changes the content displayed in the Information setting area to the "[DMA] for configuring the information necessary to control the functions of DMA (Direct Memory Access) controller provided by the microcontroller".

	Changes the content displayed in the Information setting area to the "[LVI] for configuring the information necessary to control the functions of low-voltage detector provided by the microcontroller".

(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 the following sections for details on this area.

- [System]
- [External Bus]
- [Port]
- [INT]
- [Serial]
- [A/D]
- [D/A]
- [Timer]
- [Watch Timer]
- [RTC]
- [Real-Time Output]
- [DMA]
- [LVI]

Remark See User's Manual for Microcontroller for details on the items to be set.

[[File] menu (Code Generator panel-dedicated items)]

Save Code Generator Report	Outputs report files (a file containing information configured using the Code Generator and a file containing information regarding the source code).

Remarks 1. The output format for the report file (either HTML or CSV) is selected by clicking [Generation] tab >> [Report type] in the Property panel.

2. The destination folder for the report file is specified by clicking [Generation] tab >> [Output folder] in the Property panel.

[[Help] menu (Code Generator panel-dedicated items)]

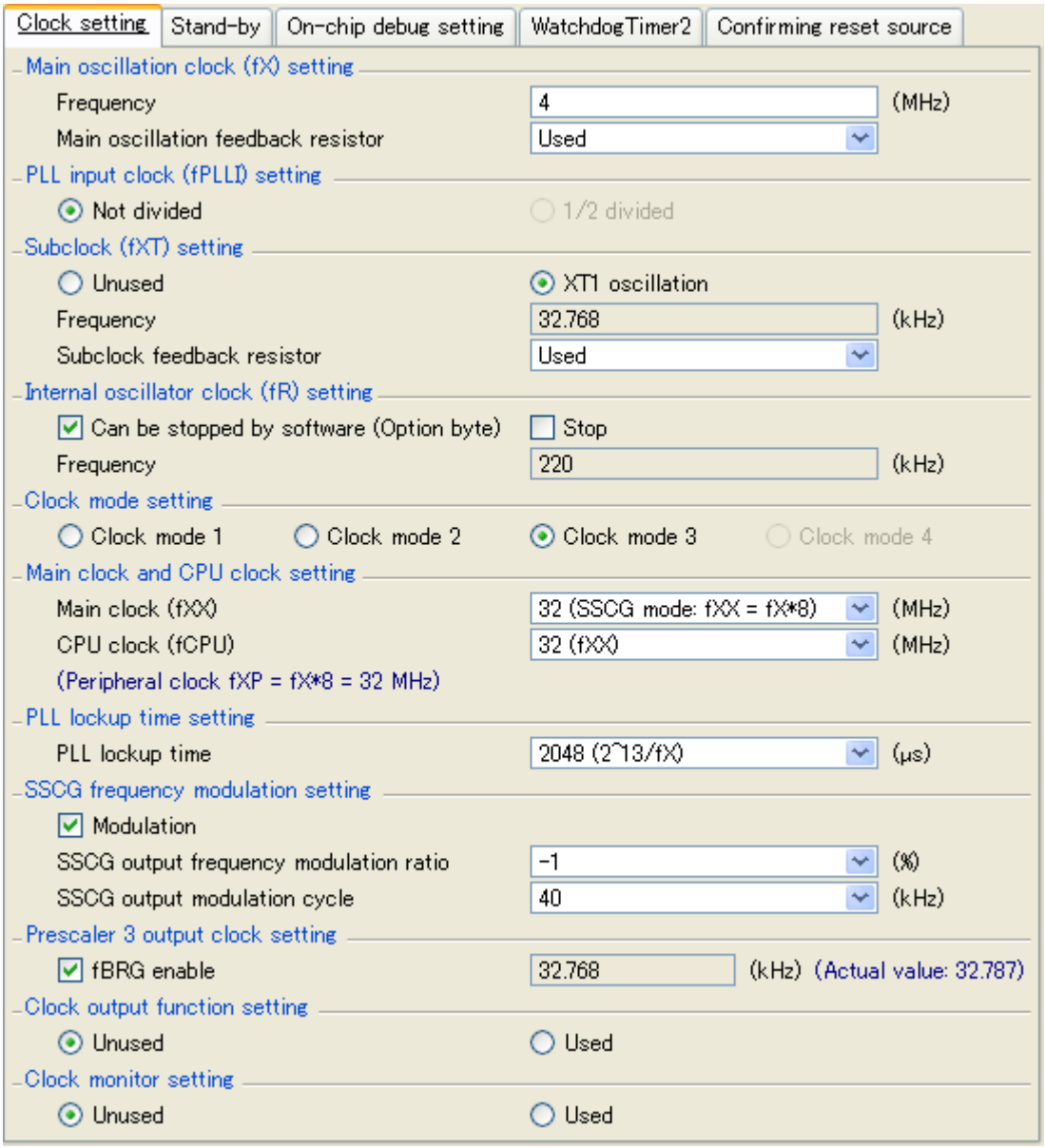
Open Help for Code Generator Panel	Displays the help of this panel.

[System]

Configure the information required to control the clock generation function, standby function, and etc. provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-17. Example of [System]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [System].

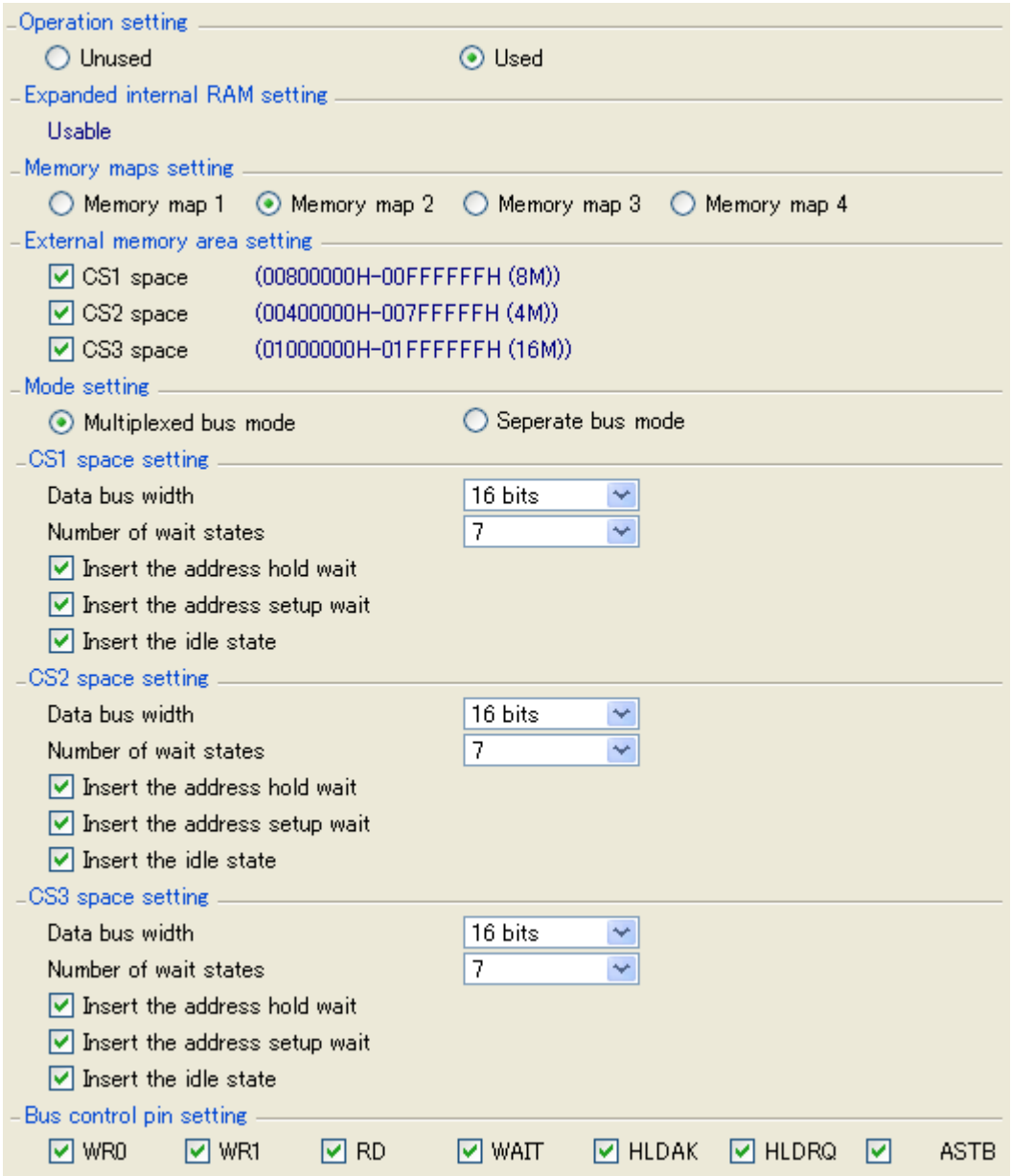
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[External Bus]

Configure the information required to control the external bus interface mode control function (function for connecting to external memory areas) provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-18. Example of [External Bus]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [External Bus].

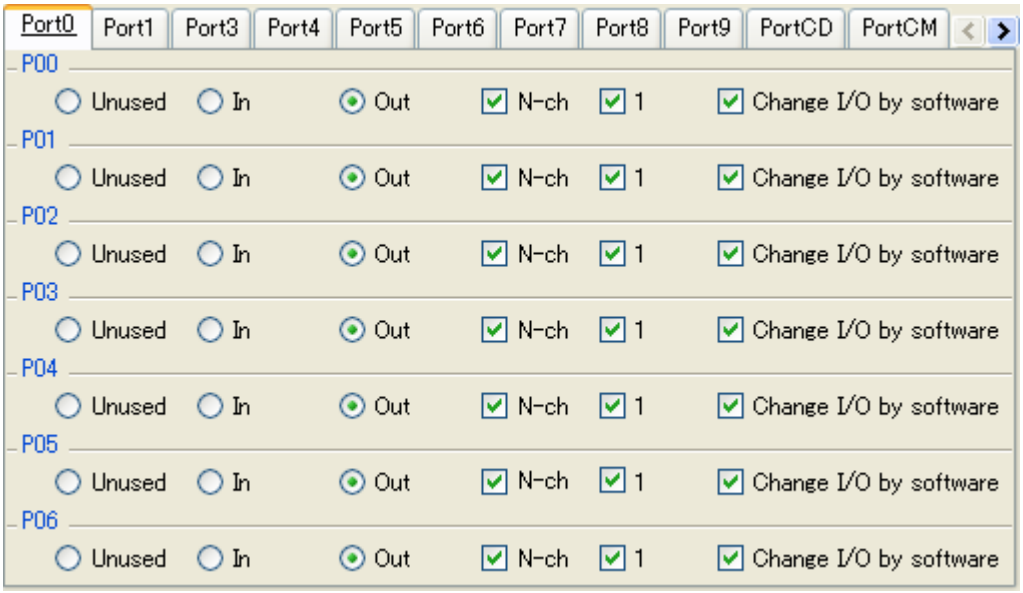
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[Port]

This panel allows you to configure the information necessary to control port functions provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-19. Example of [Port]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Port].

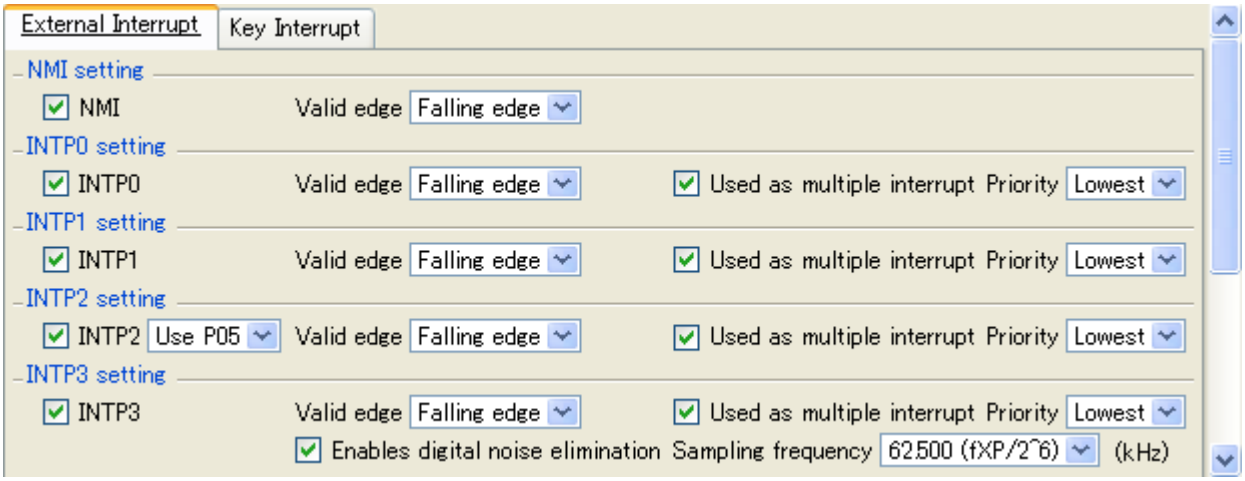
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[INT]

This panel allows you to configure the information necessary to control the external interrupt functions and the key interrupt function provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-20. Example of [INT]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [INT].

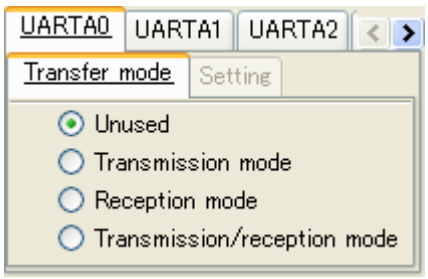
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[Serial]

Configure the information required to control the asynchronous serial interface A (UARTA), 3-wire variable-length serial I/O (CSIB), and etc. provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-21. Example of [Serial]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Serial].

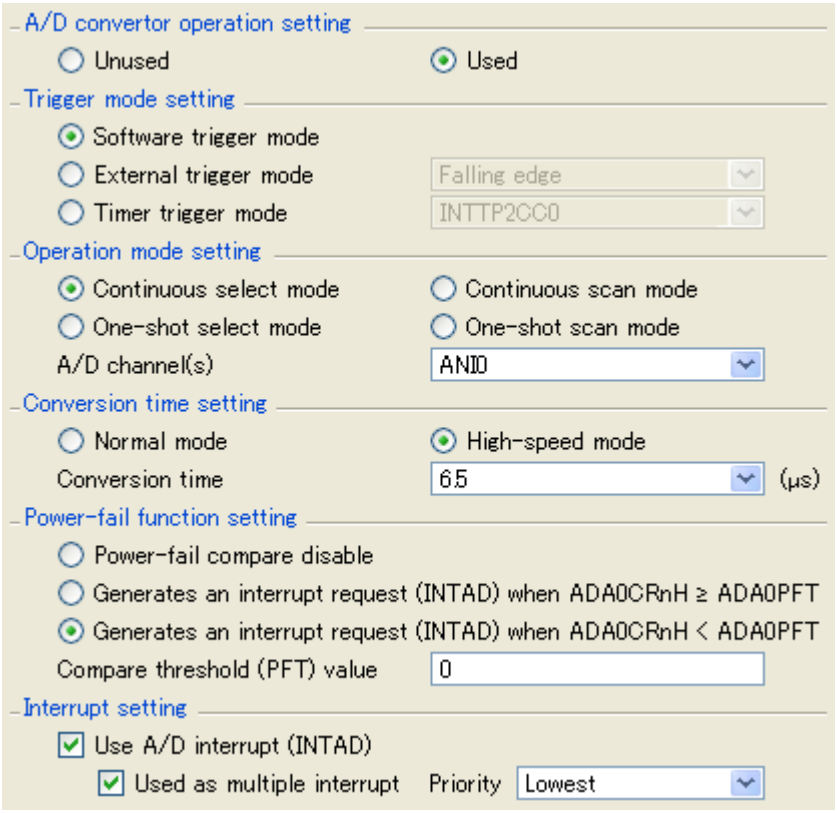
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[A/D]

This panel allows you to configure the information necessary to control the function of A/D converter provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-22. Example of [A/D]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [A/D].

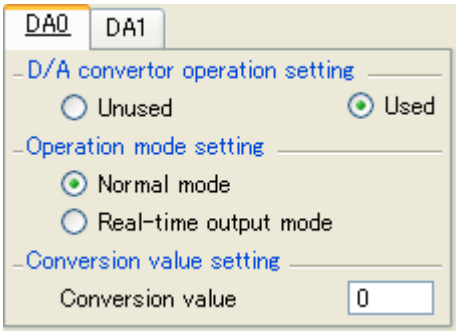
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[D/A]

This panel allows you to configure the information necessary to control the function of D/A converter provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-23. Example of [D/A]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [D/A].

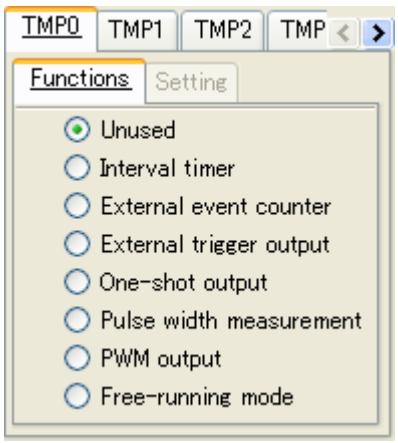
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[Timer]

Configure the information required to control the 16-bit timer/event counter P (TMP), 16-bit timer/event counter Q (TMQ), and 16-bit interval timer M (TMM) functions provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-24. Example of [Timer]



[How to open]

- On the Project Tree panel, select [Project name (Project)] >> [Code Generator (Design Tool)] >> [Timer].

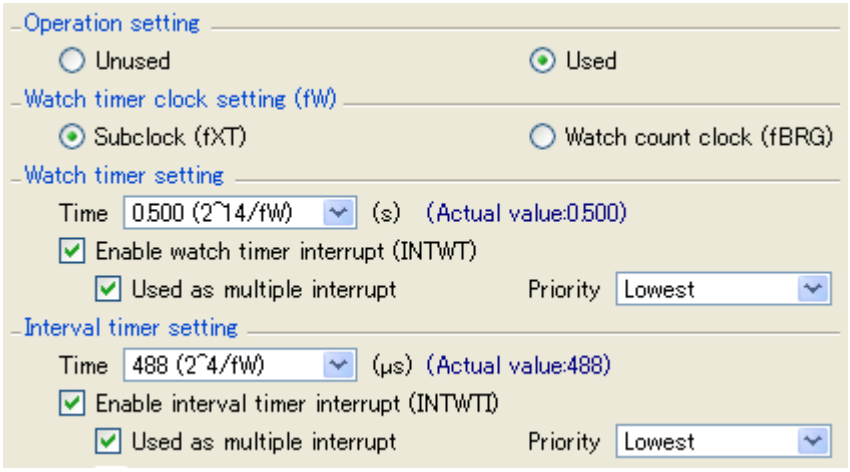
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[Watch Timer]

This panel allows you to configure the information necessary to control the function of watch timer provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-25. Example of [Watch Timer]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Watch Timer].

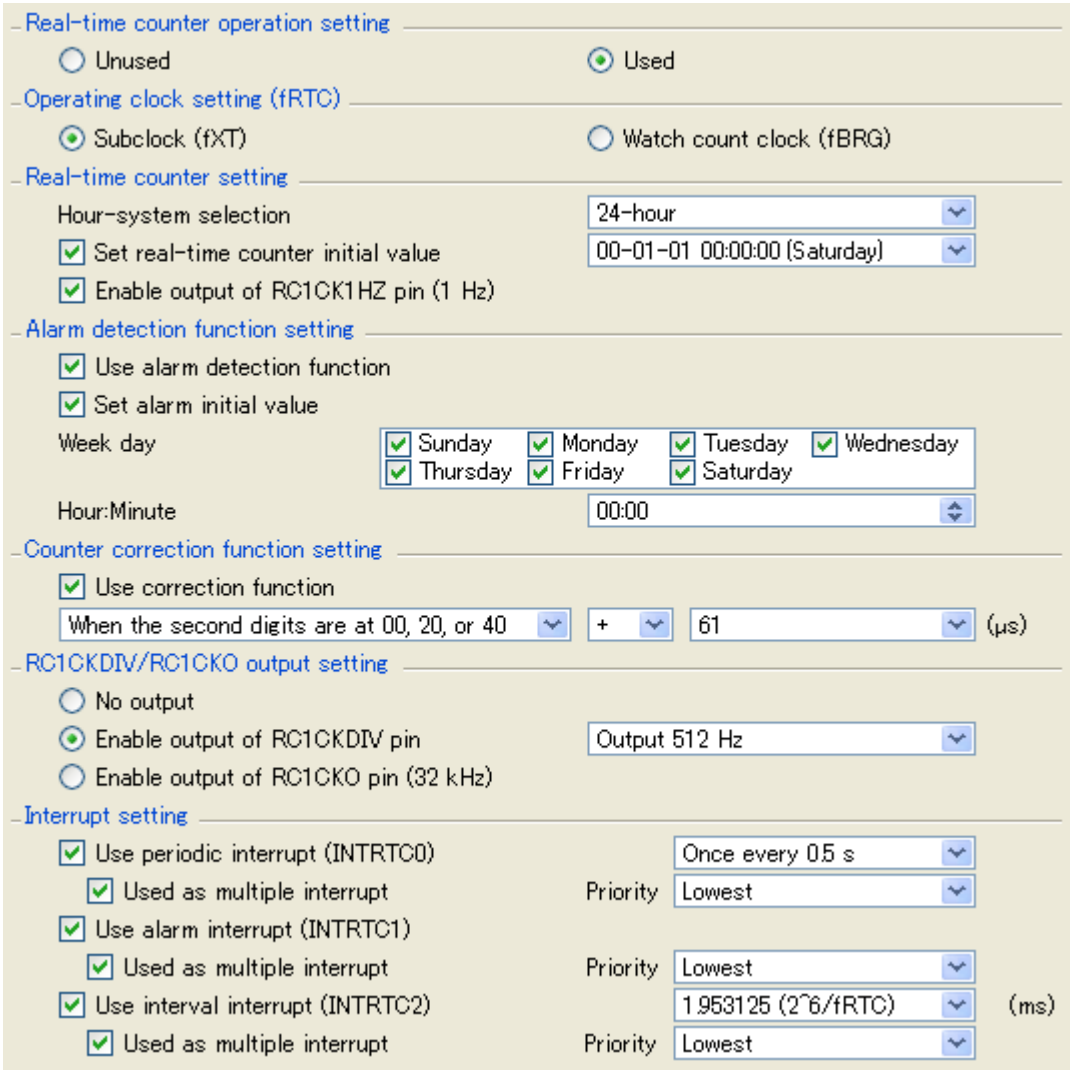
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[RTC]

This panel allows you to configure the information necessary to control the function of real-time counter provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-26. Example of [RTC]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [RTC].

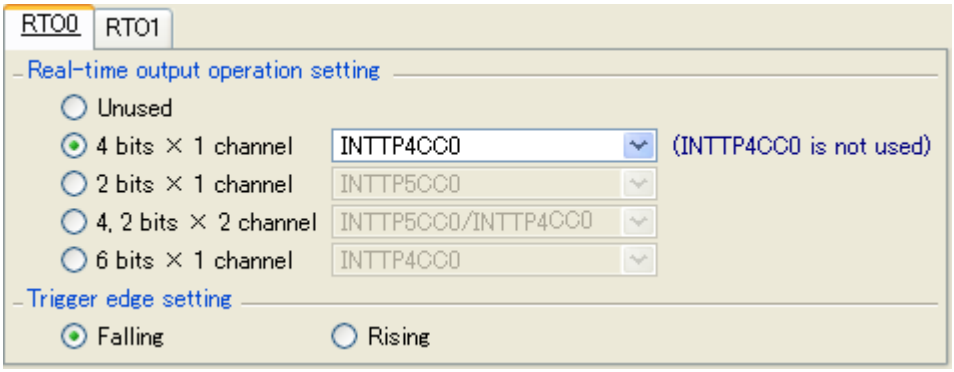
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[Real-Time Output]

This panel allows you to configure the information necessary to control real-time output functions provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-27. Example of [Real-Time Output]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [Real-Time Output].

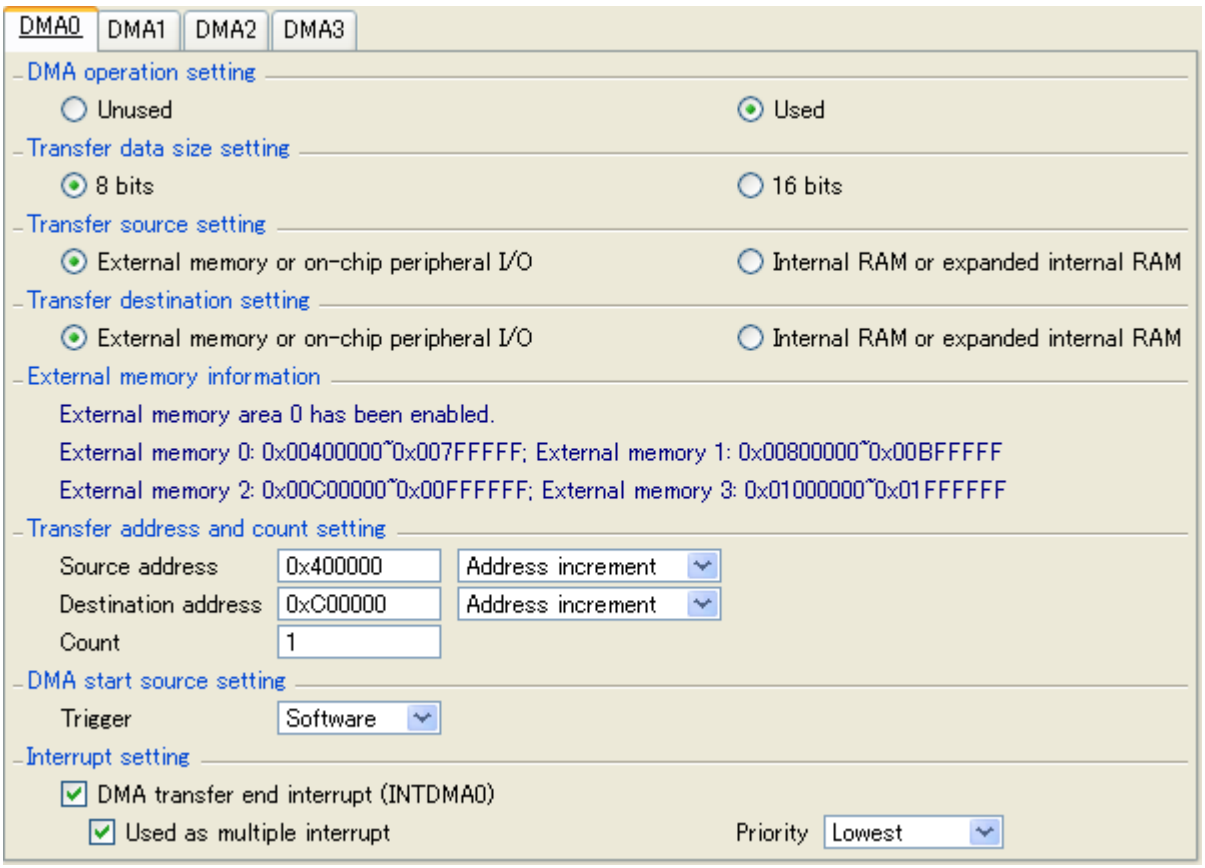
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[DMA]

This panel allows you to configure the information necessary to control the functions of DMA (Direct Memory Access) controller provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-28. Example of [DMA]



[How to open]

- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [DMA].

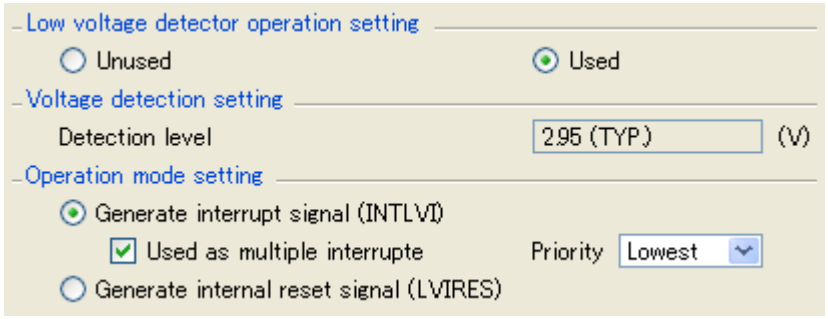
Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

[LVI]

This panel allows you to configure the information necessary to control the functions of low-voltage detector provided by the microcontroller.

Screen Structure may be different, depending on the kinds of target microcontrollers. See user's manual for details on target microcontrollers.

Figure A-29. Example of [LVI]



[How to open]

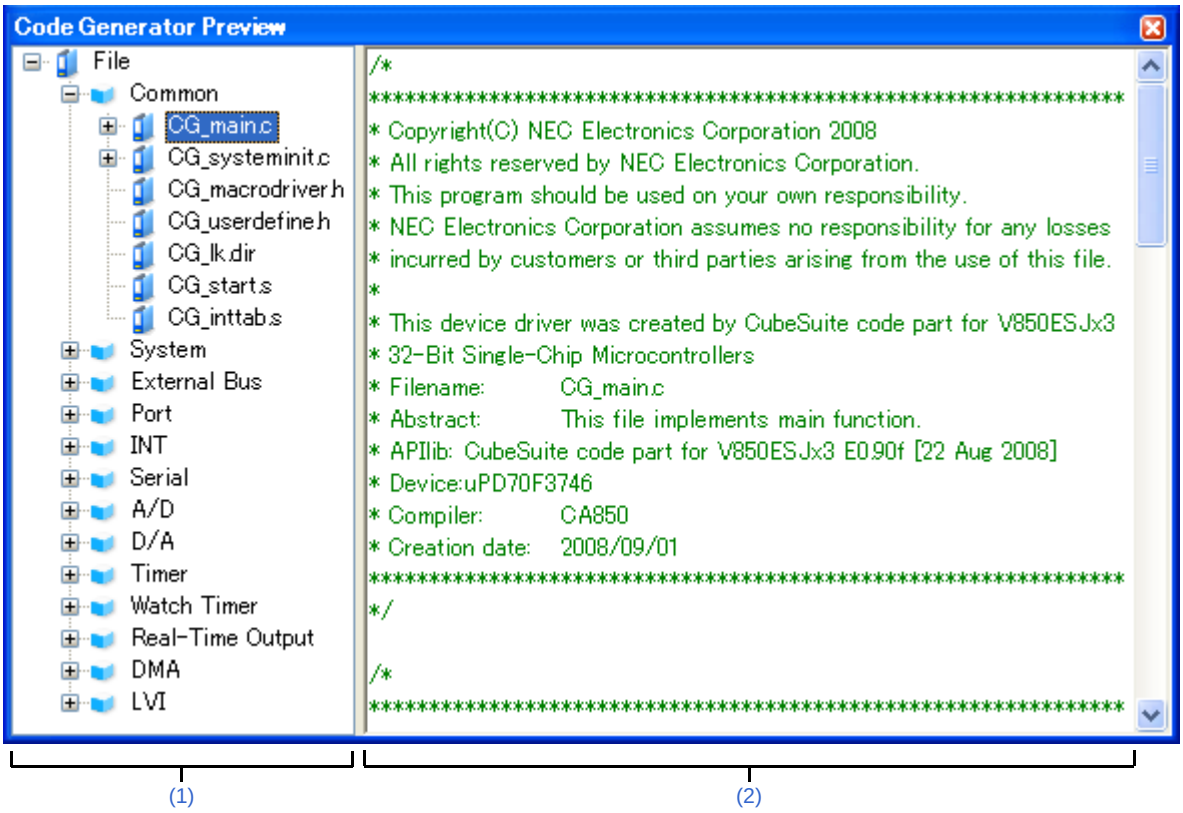
- On the Project Tree panel, select [*Project name* (Project)] >> [Code Generator (Design Tool)] >> [LVI].

Remark If the Code Generator panel is already open, pressing the button changes the content displayed accordingly.

Code Generator Preview panel

This panel allows you to confirm or configure on a per-API function basis the setting that determines whether or not the source code (device driver program) is generated when the Generate Code button is pressed in the Code Generator panel. It also allows you to confirm the source code that reflects the information configured in the Code Generator panel.

Figure A-30. Code Generator Preview Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [File] menu (Code Generator Preview panel-dedicated items)]
- [[Help] menu (Code Generator Preview panel-dedicated items)]
- [Context menu]

[How to open]

- From the [View] menu, select [Code Generator Preview].

[Description of each area]

(1) Preview tree

This area allows you to confirm or configure on a per-API function basis the setting that determines whether or not the source code (device driver program) is generated when the Generate Code button is pressed in the Code Generator panel.

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

2. To select whether or not to generate the source code, use the context menu (Generate code/Not generate code) which is displayed by right-clicking the mouse while the mouse cursor is on the desired icon in the tree.

3. You can confirm the current setting that determines whether or not to generate the source code by checking the type of icon.

Table A-2. Setting That Determines Whether or Not to Generate the 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.

(2) Source code display area

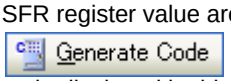
This area allows you to confirm the source code (device driver program) that reflects the information configured in the Code Generator panel.

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

Table A-3. Color of Source Code

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

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

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

button on the Code Generator 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. You can change the source code to be displayed by selecting the source file name or API function name in the preview tree.

[File] menu (Code Generator Preview panel-dedicated items)]

Save Code Generator Report	Outputs report files (a file containing information configured using the Code Generator and a file containing information regarding the source code).

Remarks 1. The output format for the report file (either HTML or CSV) is selected by clicking [Generation] tab >> [Report type] in the Property panel.

2. The destination folder for the report file is specified by clicking [Generation] tab >> [Output folder] in the Property panel.

[[Help] menu (Code Generator Preview panel-dedicated items)]

Open Help for Code Generator Preview Panel	Displays the help of this panel.

[Context menu]

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

Generate code	Makes a setting so that the source code of the currently selected API function is generated to the folder specified by selecting [Generation] tab >> [Output folder] in the Property panel. Selecting this context menu item changes the icon of the currently selected API function from  to  .
Not generate code	Makes a setting so that the source code of the currently selected API function is not generated when the  button is pressed in the Code Generator panel. Selecting this context menu item changes the icon of the currently selected API function from  to  .
Rename	Selecting this menu item changes the name portion of the currently selected file or API function into an edit box for editing the name. You can change the name of the file or API function by editing its name in the edit box.
Default	Reverts the file name or API function name to its original name before it was edited.
Property	Opens the Property panel that contains the information for the currently selected file.

Output panel

This panel displays operation logs for various components (design tool, build tool, etc.) provided by CubeSuite.

Figure A-31. Output Panel

The following items are explained here.

- [How to open]
- [Description of each area]
- [[File] menu (Output panel-dedicated items)]
- [[Edit] menu (Output panel-dedicated items)]
- [[Help] menu (Output panel-dedicated items)]
- [Context menu]

[How to open]

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

[Description of each area]

(1) Message area

This area displays operation logs for various components (design tool, build tool, etc.) provided by CubeSuite.
The following table displays the meaning of the color of the message text displayed in this area.

Table A-4. Color of Message Text/Background

Message Text/Background	Description
Block/White	Information message Displayed with information notices.
Blue/Standard color	Warning message Displayed with warnings about operations.
Red/LightGray	Fatal error message Displayed when there is a fatal error, or when execution is not possible due to a operational mistake.

Remark See the sections "[All Output Messages] tab" and "[Code Generator] tab" for details on the content displayed in this area.

(2) Tab selection area

Select the source of message.

Remark When the new message is output, "*" mark is displayed to the left of the tab name.

[[File] menu (Output panel-dedicated items)]

Save Output-*Tab Name*	Saves the message corresponding to the specified tab overwriting the existing file.
Save Output-*Tab Name* As...	Opens the Save As dialog box for naming and saving the message corresponding to the specified tab.

[[Edit] menu (Output panel-dedicated items)]

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.
Search...	Opens the Search and Replace dialog box for searching strings with the [Quick Search] tab selected.
Replace...	Opens the Search and Replace dialog box for replacing strings with the [Whole Replace] tab selected.

[[Help] menu (Output panel-dedicated items)]

Open Help for Output Panel	Displays the help of this panel.

[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.
Stop Searching	Cancels the search currently being executed. This is invalid when a search is not being executed.
Open Help for Message	Displays help for the message on the current caret location. This only applies to warning messages and error messages.

[All Output Messages] tab

This tab displays operation logs for all components (design tool, build tool, etc.) provided by CubeSuite.

Figure A-32. [All Output Messages] Tab

The following items are explained here.

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

[How to open]

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

[Description of each area]

(1) Message area

This area displays operation logs for all components (design tool, build tool, etc.) provided by CubeSuite.
The following table displays the meaning of the color of the message text displayed in this area.

Table A-5. Color of Message Text/Background

Message Text/Background	Description
Black/White	Information message Displayed with information notices.
Blue/Standard Color	Warning message Displayed with warnings about operations.
Red/LightGray	Fatal error message Displayed when there is a fatal error, or when execution is not possible due to a operational mistake.

[Code Generator] tab

This tab displays only operation logs for the Code Generator out of those for various components (design tool, build tool, etc.) provided by CubeSuite.

Figure A-33. [Code Generator] Tab

The following items are explained here.

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

[How to open]

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

[Description of each area]

(1) Message area

This area displays only operation logs for the Code Generator out of those for various components (design tool, build tool, etc.) provided by CubeSuite.

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

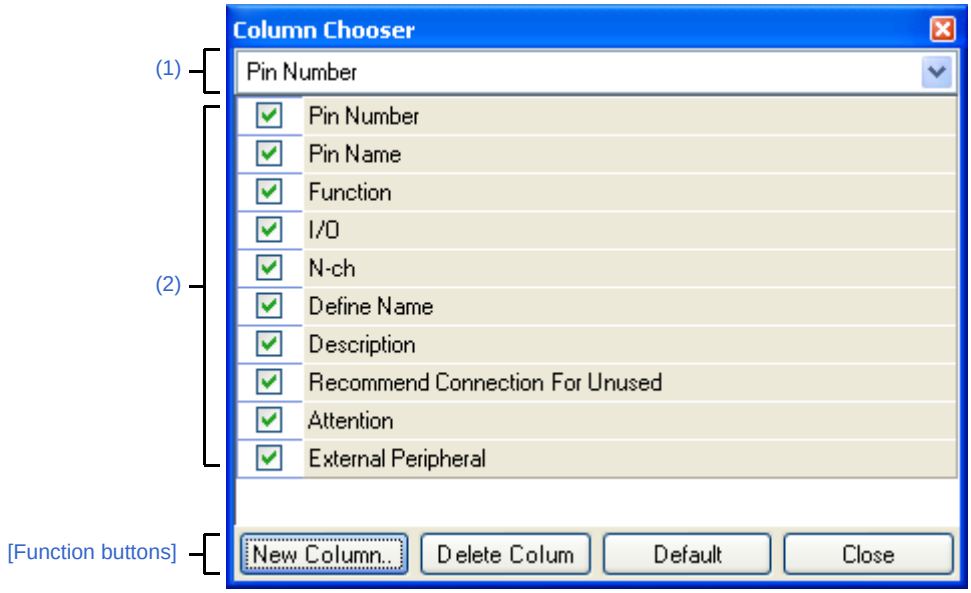
Table A-6. Color of Message Text/Background

Message Text/Background	Outline
Black/White	Information message Displayed with information notices.
Blue/Standard Color	Warning message Displayed with warnings about operations.
Red/LightGray	Fatal error message Displayed when there is a fatal error, or when execution is not possible due to a operational mistake.

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-34. 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.

Figure A-35. Operational Object ([Pin Number] Tab)

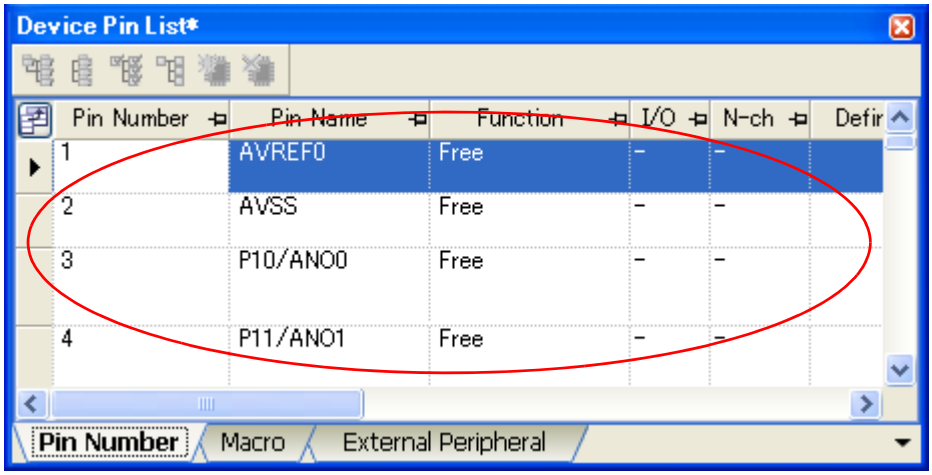


Figure A-36. Operational Object ([Macro] Tab: First Layer)

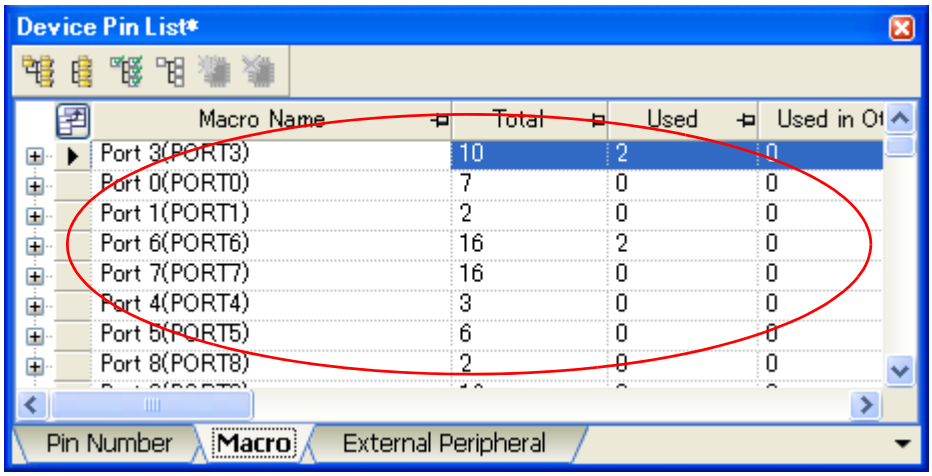


Figure A-37. Operational Object ([Macro] Tab: Second Layer)

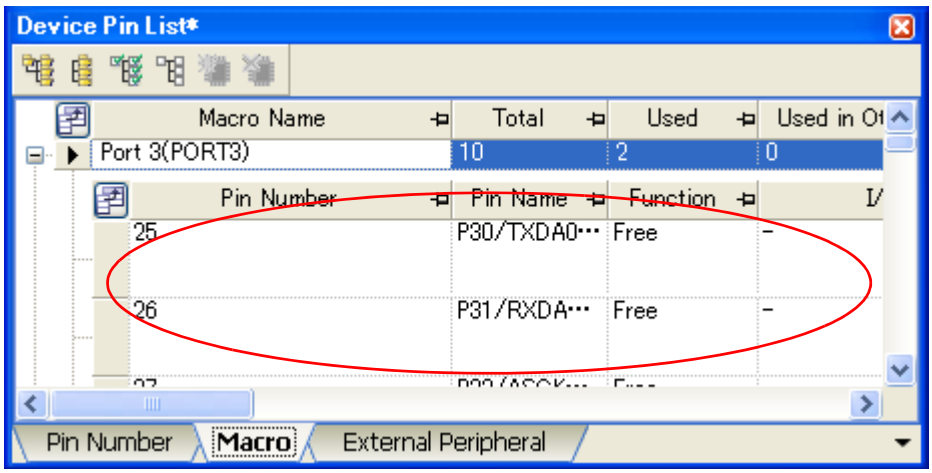


Figure A-38. Operational Object ([External Peripheral] Tab: First Layer)

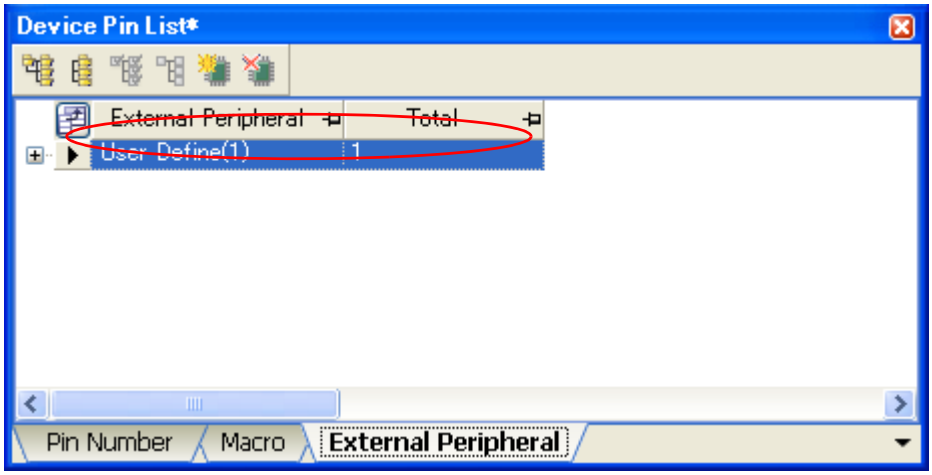
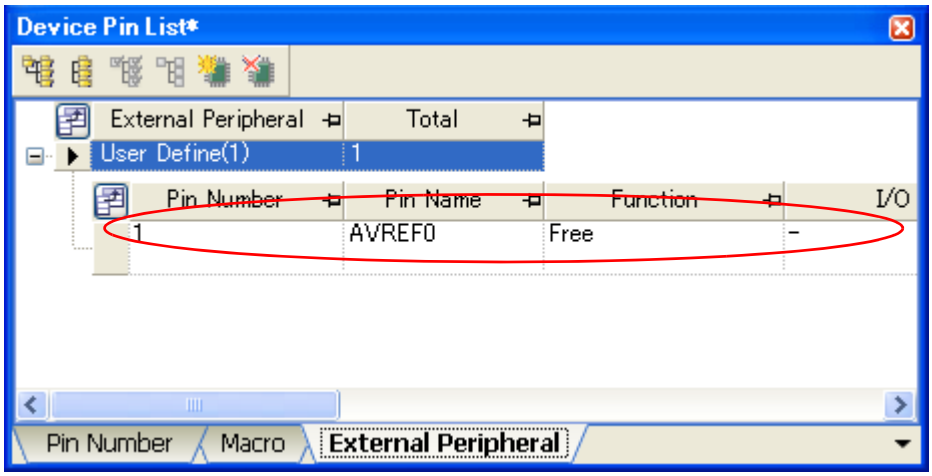


Figure A-39. Operational Object ([External Peripheral] Tab: Second Layer)



(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.

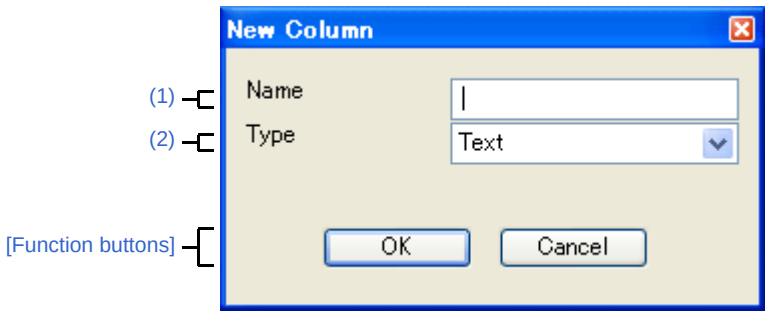
[Function buttons]

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-40. 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.

(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.

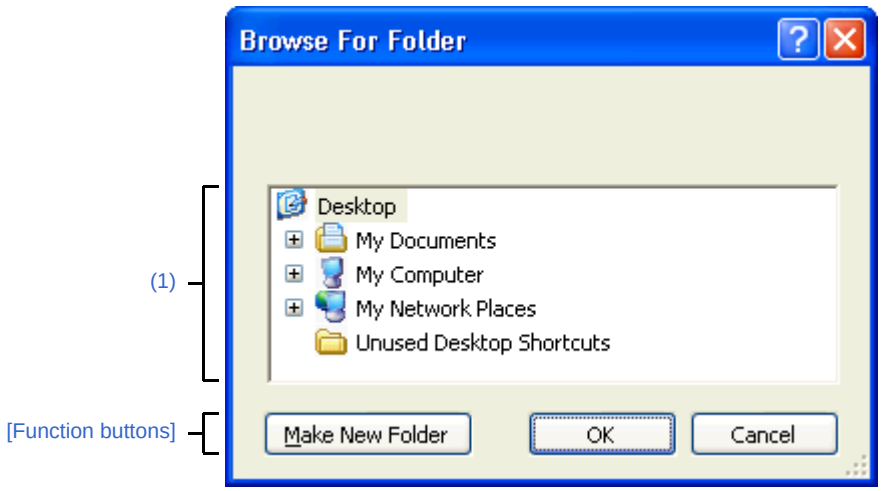
[Function buttons]

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.

Browse For Folder dialog box

This dialog box allows you to specify the output destination for files (source code, report file, etc.).

Figure A-41. Browse For Folder Dialog Box



The following items are explained here.

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

[How to open]

- In the [Generation] tab of the Property panel, click the [...] button in [Output folder].

[Description of each area]

(1) Folder location

Select the folder to which the files (source code, report file, etc.) are output.

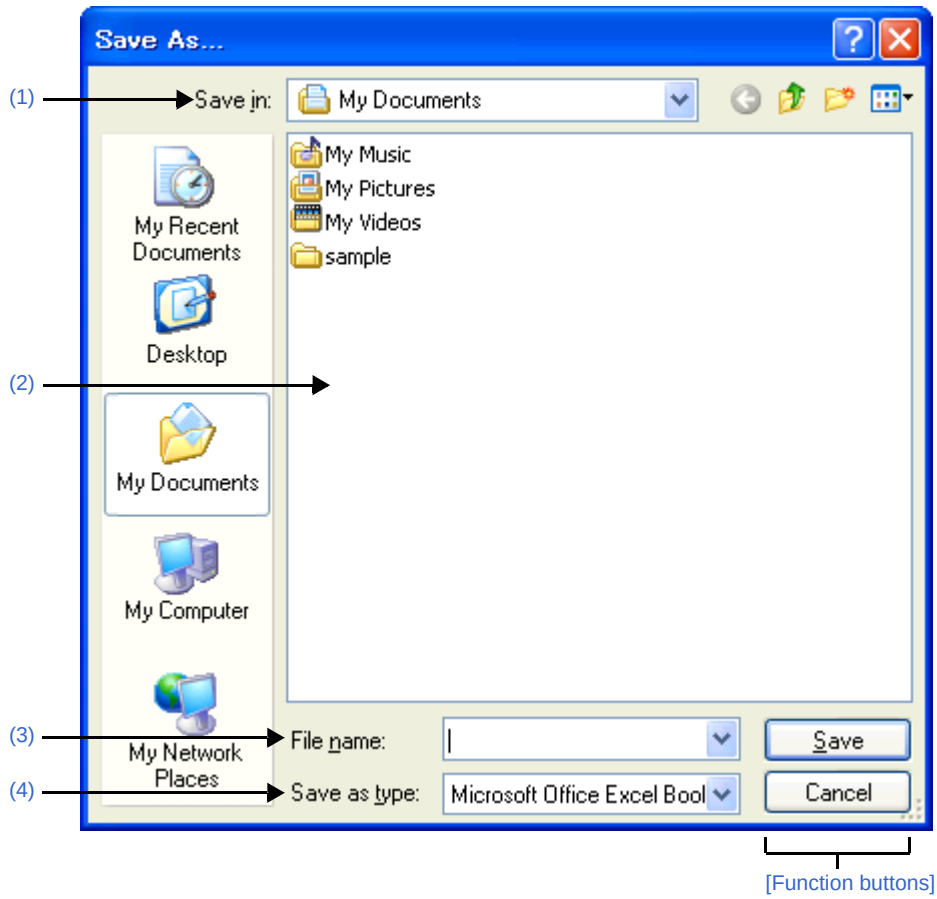
[Function buttons]

Button	Function
Make New Folder	Creates a "New Folder" below the folder selected in the Folder location.
OK	Specifies the folder selected in the Folder location as the destination for the files.
Cancel	Ignores the setting and closes this dialog box.

Save As dialog box

This dialog box allows you to name and save a file (such as a report file).

Figure A-42. 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 <object> As...].

[Description of each area]

(1) [Save in]

Select the folder to which the files (report files, etc.) are output.

(2) List of files

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

(3) [File name]

Specify the name of the file to be output.

(4) [Save as type]

Select the type of the file to be output.

Microsoft Office Excel Book (*.xls)	Microsoft Office Excel Book format
Bitmap (*.bmp)	Bitmap format
PNG (*.png)	PMG format
JPEG (*.jpg)	JPEG format
EMF (*.emf)	EMF format

[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 [Save in].
Cancel	Ignores the setting and closes this dialog box.

APPENDIX B OUTPUT FILES

This appendix describes the files output by Code Generator.

B.1 Overview

Below is a list of files output by Code Generator.

Table B-1. File List

Unit of Output	File Name	Description
Peripheral function	*PeripheralFunctionName*.c	Initial function, API function
	*PeripheralFunctionName*_user.c	Interrupt function, callback function
	PeripheralFunctionName.h	Defines macros for assigning values to registers
Project	option.asm	Option bytes, secures ROM for MINICUBE2
	option.inc	Defines macros for setting values in option bytes
	systeminit.c	Call initial function of peripheral function Call CG_ReadResetSource
	main.c	main function
	macrodriver.h	Defines common macros used by all source files
	user_define.h	Empty file (for user definitions)
	lk.dir	Link directive

B.2 Output File

Below are the files (peripheral function) output by Code Generator.

Table B-2. File List (Peripheral Function)

Peripheral Function	Source File Name	Names of API Functions Included
System	CG_system.c	CLOCK_Init CG_ChangeClockMode CG_ChangeFrequency CG_SelectPowerSaveMode CG_SelectStabTime CG_SelectPllMode CG_SelectSSCGMode WDT2_Restart CRC_Start CRC_SetData CRC_GetResult
	CG_system_user.c	MD_INTWDT2 CLOCK_UserInit CG_ReadResetSource
	CG_system.h	-
External Bus	CG_bus.c	BUS_Init
	CG_bus_user.c	BUS_UserInit

Peripheral Function	Source File Name	Names of API Functions Included
External Bus	CG_bus.h	-
Port	CG_port.c	PORT_Init PORT_ChangePmnInput PORT_ChangePmnOutput
	CG_port_user.c	PORT_UserInit
	CG_port.h	-
INT	CG_int.c	INTP_Init KEY_Init INT_MaskableInterruptEnable INTPn_Disable INTPn_Enable KEY_Disable KEY_Enable
	CG_int_user.c	MD_INTNMI MD_INTP*n* MD_INTKR INTP_UserInit KEY_UserInit
	CG_int.h	-
Serial	CG_serial.c	UARTAn_Init UARTAn_Start UARTAn_Stop UARTAn_SendData UARTAn_ReceiveData UARTBn_Init UARTBn_Start UARTBn_Stop UARTBn_SendData UARTBn_ReceiveData UARTCn_Init UARTCn_Start UARTCn_Stop UARTCn_SendData UARTCn_ReceiveData CSIBn_Init CSIBn_Start CSIBn_Stop CSIBn_SendData CSIBn_ReceiveData CSIBn_SendReceiveData CSIEn_Init CSIEn_Start CSIEn_Stop CSIEn_SendData CSIEn_ReceiveData CSIEn_SendReceiveData

Peripheral Function	Source File Name	Names of API Functions Included
Serial	CG_serial.c	CSIFn_Init CSIFn_Start CSIFn_Stop CSIFn_SendData CSIFn_ReceiveData IIC0n_Init IIC0n_Stop IIC0n_StopCondition IIC0n_MasterSendStart IIC0n_MasterReceiveStart IIC0n_SlaveSendStart IIC0n_SlaveReceiveStart
	CG_serial_user.c	MD_INTUA*n*T MD_INTUA*n*R MD_INTUB*n*TIT MD_INTUB*n*TIF MD_INTUB*n*TIR MD_INTUB*n*TIRE MD_INTUB*n*TITO MD_INTUC*n*T MD_INTUC*n*R MD_INTCB*n*T MD_INTCB*n*R MD_INTCE*n*T MD_INTCE*n*TIOF MD_INTCF*n*T MD_INTCF*n*R MD_INTIIC*n* UARTAn_UserInit UARTAn_SendEndCallback UARTAn_ReceiveEndCallback UARTAn_ErrorCallback UARTAn_SoftOverRunCallback UARTBn_UserInit UARTBn_SendEndCallback UARTBn_ReceiveEndCallback UARTBn_SingleErrorCallback UARTBn_FIFOErrorCallback UARTBn_TimeoutErrorCallback UARTBn_SoftOverRunCallback UARTCn_UserInit UARTCn_SendEndCallback UARTCn_ReceiveEndCallback UARTCn_ErrorCallback UARTCn_SoftOverRunCallback CSIBn_UserInit CSIBn_SendEndCallback

Peripheral Function	Source File Name	Names of API Functions Included
Serial	CG_serial_user.c	CSIBn_ReceiveEndCallback CSIBn_ErrorCallback CSIEn_UserInit CSIEn_SendEndCallback CSIEn_ReceiveEndCallback CSIEn_ErrorCallback CSIFn_UserInit CSIFn_SendEndCallback CSIFn_ReceiveEndCallback CSIFn_ErrorCallback IIC0n_UserInit IIC0n_MasterSendEndCallback IIC0n_MasterReceiveEndCallback IIC0n_MasterErrorCallback IIC0n_SlaveSendEndCallback IIC0n_SlaveReceiveEndCallback IIC0n_SlaveErrorCallback IIC0n_GetStopConditionCallback
	CG_serial.h	-
A/D	CG_ad.c	AD_Init AD_Start AD_Stop AD_SelectADChannel AD_SetPFTCondition AD_Read AD_ReadByte
	CG_ad_user.c	MD_INTAD AD_UserInit
	CG_ad.h	-
D/A	CG_da.c	DAn_Init DAn_Start DAn_Stop DAn_SetValue
	CG_da_user.c	DAn_UserInit
	CG_da.h	-
Timer	CG_timer.c	TMPn_Init TMPn_Start TMPn_Stop TMPn_ChangeTimerCondition TMPn_GetPulseWidth TMPn_GetFreeRunningValue TMPn_ChangeDuty TMPn_SoftwareTriggerOn TMQ0_Init TMQ0_Start

Peripheral Function	Source File Name	Names of API Functions Included
Timer	CG_timer.c	TMQ0_Stop TMQ0_ChangeTimerCondition TMQ0_GetPulseWidth TMQ0_GetFreeRunningValue TMQ0_ChangeDuty TMQ0_SoftwareTriggerOn TAAn_Init TAAn_Start TAAn_Stop TAAn_ChangeTimerCondition TAAn_ControlOutputToggle TAAn_GetPulseWidth TAAn_GetFreeRunningValue TAAn_ChangeDuty TAAn_SoftwareTriggerOn TABn_Init TABn_Start TABn_Stop TABn_ChangeTimerCondition TABn_ControlOutputToggle TABn_GetPulseWidth TABn_GetFreeRunningValue TABn_ChangeDuty TABn_SoftwareTriggerOn TMT0_Init TMT0_Start TMT0_Stop TMT0_ChangeTimerCondition TMT0_GetPulseWidth TMT0_GetFreeRunningValue TMT0_ChangeDuty TMT0_SoftwareTriggerOn TMT0_EnableHold TMT0_DisableHold TMT0_ChangeCountValue TMMn_Init TMMn_Start TMMn_Stop TMMn_ChangeTimerCondition
	CG_timer_user.c	MD_INTTP*n*OV MD_INTTP*n*CC*m* MD_INTTQ0OV MD_INTTQ0CC*m* MD_INTTTAA*n*OV MD_INTTAA*n*CC*m* MD_INTTTAB*n*OV MD_INTTAB*n*CC*m*

Peripheral Function	Source File Name	Names of API Functions Included
Timer	CG_timer_user.c	MD_INTTT0EC MD_INTTT0OV MD_INTTT0CC*m* MD_INTTM*n*EQ0 TMPn_UserInit TMQ0_UserInit TAAn_UserInit TABn_UserInit TMT0_UserInit TMMn_UserInit
	CG_timer.h	-
Watch Timer	CG_wt.c	WT_Init WT_Start WT_Stop
	CG_wt_user.c	MD_INTWT MD_INTWTI WT_UserInit
	CG_wt.h	-
RTC	CG_rtc.c	RTC_Init RTC_CounterEnable RTC_CounterDisable RTC_SetHourSystem RTC_CounterSet RTC_CounterGet RTC_ConstPeriodInterruptEnable RTC_ConstPeriodInterruptDisable RTC_AlarmEnable RTC_AlarmDisable RTC_AlarmSet RTC_AlarmGet RTC_IntervalStart RTC_IntervalStop RTC_IntervalInterruptEnable RTC_IntervalInterruptDisable RTC_RC1CK1HZ_OutputEnable RTC_RC1CK1HZ_OutputDisable RTC_RC1CKO_OutputEnable RTC_RC1CKO_OutputDisable RTC_RC1CKDIV_OutputEnable RTC_RC1CKDIV_OutputDisable RTC_RTC1HZ_OutputEnable RTC_RTC1HZ_OutputDisable RTC_RTCCL_OutputEnable RTC_RTCCL_OutputDisable RTC_RTCDIV_OutputEnable RTC_RTCDIV_OutputDisable

Peripheral Function	Source File Name	Names of API Functions Included
RTC	CG_rtc.c	RTC_ChangeCorrectionValue
	CG_rtc_user.c	MD_INTRTC*n* RTC_UserInit
	CG_rtc.h	-
Real-Time Output	CG_rto.c	RTOn_Init RTOn_Enable RTOn_Disable RTOn_Set2BitData RTOn_Set4BitData RTOn_Set6BitData RTOn_Set8BitData RTOn_SetHigh2BitData RTOn_SetLow2BitData RTOn_SetHigh4BitData RTOn_SetLow4BitData RTOn_GetValue
	CG_rto_user.c	RTOn_UserInit
	CG_rto.h	-
DMA	CG_dma.c	DMAn_Init DMAn_Enable DMAn_Disable DMAn_CheckStatus DMAn_SetData DMAn_SoftwareTriggerOn
	CG_dma_user.c	MD_INTDMA*n* DMAn_UserInit
	CG_dma.h	-
LVI	CG_lvi.c	LVI_Init LVI_InterruptModeStart LVI_ResetModeStart LVI_Start LVI_Stop
	CG_lvi_user.c	MD_INTLVI LVI_UserInit
	CG_lvi.h	-

APPENDIX C API FUNCTIONS

This appendix describes the API functions output by Code Generator.

C.1 Overview

Below are the naming conventions for API functions output by 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 local variables start with a "p" and are in all lower 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 Output Function

Below is a list of API functions output by Code Generator.

Table C-1. API Function List

Peripheral Function	API Function Name	Function
System	CLOCK_Init	Performs initialization necessary to control clock functions.
	CLOCK_UserInit	Performs user-defined initialization relating to the clock.
	CG_ReadResetSource	Performs processing in response to a reset signal.
	CG_ChangeClockMode	Changes the CPU clock.
	CG_ChangeFrequency	Changes the CPU clock division ratio.
	CG_SelectPowerSaveMode	Configures the CPU's standby function.
	CG_SelectStabTime	Selects the oscillation stabilization time for the X1 oscillator. This will become necessary when STOP mode is released.
	CG_SelectPllMode	Selects the operation mode of the PLL function.
	CG_SelectSSCGMode	Selects the operation mode of the SSCG (Spread Spectrum Clock Generator).
	WDT2_Restart	Clears the watchdog timer counter and resumes counting.
	CRC_Start	Begins detection of data-block errors.
	CRC_SetData	Sets data in the CRC input register (CRCIN).
	CRC_GetResult	Reads the results of the calculation stored in the CRC data register (CRCD).
External Bus	BUS_Init	Performs initialization necessary to control external bus interface functions (functions to connect an external bus to areas other than onboard ROM, ROM and RAM).
	BUS_UserInit	Performs user-defined initialization relating to the external bus interface.

Peripheral Function	API Function Name	Function
Port	PORT_Init	Performs initialization necessary to control port functions.
	PORT_UserInit	Performs user-defined initialization relating to the port.
	PORT_ChangePmnInput	Switches the pin's I/O mode from output mode to input mode.
	PORT_ChangePmnOutput	Switches the pin's I/O mode from input mode to output mode.
INT	INTP_Init	Performs initialization necessary to control the external interrupt INTP*n* functions.
	INTP_UserInit	Performs user-defined initialization relating to the external interrupt INTP*n* functions.
	KEY_Init	Performs initialization necessary to control the key interrupt INTKR functions.
	KEY_UserInit	Performs user-defined initialization relating to the key interrupt INTKR functions.
	INT_MaskableInterruptEnable	Disables/enables the acceptance of the maskable interrupts.
	INTPn_Disable	Disables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).
	INTPn_Enable	Enables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).
	KEY_Disable	Disables the acceptance of the key interrupts INTKR.
	KEY_Enable	Enables the acceptance of the key interrupts INTKR.
Serial	UARTAn_Init	Performs initialization necessary to control the asynchronous serial interface A (UARTA) functions.
	UARTAn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface A (UARTA).
	UARTAn_Start	Enables asynchronous serial interface A (UARTA).
	UARTAn_Stop	Disables asynchronous serial interface A (UARTA).
	UARTAn_SendData	Starts UARTA*n* data transmission.
	UARTAn_ReceiveData	Starts UARTA*n* data reception.
	UARTAn_SendEndCallback	Performs processing in response to the UARTA*n* consecutive transmission enable interrupt INTUA*n*T.
	UARTAn_ReceiveEndCallback	Performs processing in response to the UARTA*n* reception completion interrupt INTUA*n*R.
	UARTAn_ErrorCallback	Performs processing in response to the UARTA*n* reception error interrupt INTUA*n*R (overrun error, framing error, parity error).
	UARTAn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
	UARTBn_Init	Performs initialization necessary to control the asynchronous serial interface B (UARTB) functions.
	UARTBn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface B (UARTB).

Peripheral Function	API Function Name	Function
Serial	UARTBn_Start	Enables asynchronous serial interface B (UARTB).
	UARTBn_Stop	Disables asynchronous serial interface B (UARTB).
	UARTBn_SendData	Starts UARTB*n* data transmission.
	UARTBn_ReceiveData	Starts UARTB*n* data reception.
	UARTBn_SendEndCallback	Performs processing consequent to the transmission enable interrupt INTUB*n*TIT and the FIFO transmission completion interrupt INTUB*n*TIF.
	UARTBn_ReceiveEndCallback	Performs processing in response to the reception completion interrupt INTUB*n*TIR.
	UARTBn_SingleErrorCallback	Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).
	UARTBn_FIFOErrorCallback	Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).
	UARTBn_TimeoutErrorCallback	Performs processing in response to the reception timeout error interrupt INTUB*n*TITO.
	UARTBn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
	UARTCn_Init	Performs initialization necessary to control the asynchronous serial interface A (UARTA) functions.
	UARTCn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface A (UARTA).
	UARTCn_Start	Enables asynchronous serial interface A (UARTA).
	UARTCn_Stop	Disables asynchronous serial interface A (UARTA).
	UARTCn_SendData	Starts UARTA*n* data transmission.
	UARTCn_ReceiveData	Starts UARTA*n* data reception.
	UARTCn_SendEndCallback	Performs processing in response to the UARTA*n* consecutive transmission enable interrupt INTUA*n*T.
	UARTCn_ReceiveEndCallback	Performs processing in response to the UARTA*n* reception completion interrupt INTUA*n*R.
	UARTCn_ErrorCallback	Performs processing in response to the UARTA*n* reception error interrupt INTUA*n*R (overrun error, framing error, parity error).
	UARTCn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
	CSIBn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O B (CSIB) functions.
	CSIBn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O B (CSIB).
	CSIBn_Start	Enables 3-wire variable-length serial I/O B (CSIB).
	CSIBn_Stop	Disables 3-wire variable-length serial I/O B (CSIB).
	CSIBn_SendData	Starts CSIB data transmission.

Peripheral Function	API Function Name	Function
Serial	CSIBn_ReceiveData	Starts CSIB data reception.
	CSIBn_SendReceiveData	Starts CSIB data transmission/reception.
	CSIBn_SendEndCallback	Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R or the CSIB*n* consecutive transmission write enable interrupt INTCB*n*T.
	CSIBn_ReceiveEndCallback	Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R.
	CSIBn_ErrorCallback	Performs processing in response to the CSIB*n* reception error interrupt INTCB*n*R (overrun error).
	CSIEn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O E (CSIE) functions.
	CSIEn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O E (CSIE).
	CSIEn_Start	Enables 3-wire variable-length serial I/O E (CSIE).
	CSIEn_Stop	Disables 3-wire variable-length serial I/O E (CSIE).
	CSIEn_SendData	Starts CSIE data transmission.
	CSIEn_ReceiveData	Starts CSIE data reception.
	CSIEn_SendReceiveData	Starts CSIE data transmission/reception.
	CSIEn_SendEndCallback	Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.
	CSIEn_ReceiveEndCallback	Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.
	CSIEn_ErrorCallback	Performs processing in response to the CSIE*n*BUF overflow interrupt INTCE*n*TIOF.
	CSIFn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O F (CSIF) functions.
	CSIFn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O F (CSIF).
	CSIFn_Start	Enables 3-wire variable-length serial I/O F (CSIF).
	CSIFn_Stop	Disables 3-wire variable-length serial I/O F (CSIF).
	CSIFn_SendData	Starts CSIF data transmission.
	CSIFn_ReceiveData	Starts CSIF data reception.
	CSIFn_SendReceiveData	Starts CSIF data transmission/reception.
	CSIFn_SendEndCallback	Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.
	CSIFn_ReceiveEndCallback	Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.
	CSIFn_ErrorCallback	Performs processing in response to the CSIF*n* reception error interrupt INTCF*n*R (overrun error).
	IIC0n_Init	Performs initialization necessary to control the IIC bus functions.

Peripheral Function	API Function Name	Function
Serial	IIC0n_UserInit	Performs user-defined initialization relating to the IIC bus.
	IIC0n_Stop	Ends IIC0*n* communication.
	IIC0n_StopCondition	Generates a stop condition.
	IIC0n_MasterSendStart	Starts IIC0*n* master transmission.
	IIC0n_MasterReceiveStart	Starts IIC0*n* master reception.
	IIC0n_MasterSendEndCallback	Performs processing in response to the IIC*n* master transfer completion interrupt INTIIC*n*.
	IIC0n_MasterReceiveEndCallback	Performs processing in response to the IIC*n* master transfer completion interrupt INTIIC*n*.
	IIC0n_MasterErrorCallback	Performs processing in response to detection of error in IIC*n* master communication.
	IIC0n_SlaveSendStart	Starts IIC0*n* slave transmission.
	IIC0n_SlaveReceiveStart	Starts IIC0*n* slave reception.
	IIC0n_SlaveSendEndCallback	Performs processing in response to the IIC*n* slave transfer completion interrupt INTIIC*n*.
	IIC0n_SlaveReceiveEndCallback	Performs processing in response to the IIC*n* slave transfer completion interrupt INTIIC*n*.
	IIC0n_SlaveErrorCallback	Performs processing in response to detection of error in IIC*n* slave communication.
	IIC0n_GetStopConditionCallback	Performs processing in response to detection of stop condition.
A/D	AD_Init	Performs initialization necessary to control A/D converter functions.
	AD_UserInit	Performs user-defined initialization relating to the A/D converter.
	AD_Start	Starts A/D conversion.
	AD_Stop	Ends A/D conversion.
	AD_SelectADChannel	Configures the analog voltage input pin for A/D conversion.
	AD_SetPFTCondition	Sets the information for operation in power-fail compare mode (comparison value and A/D conversion end interrupt INTAD trigger).
	AD_Read	Reads the results of A/D conversion (10 bits).
	AD_ReadByte	Reads the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution).
D/A	DAn_Init	Performs initialization necessary to control D/A converter functions.
	DAn_UserInit	Performs user-defined initialization relating to the D/A converter.
	DAn_Start	Starts D/A conversion.
	DAn_Stop	Ends D/A conversion.
	DAn_SetValue	Sets the analog voltage output to the ANO*n* pin.

Peripheral Function	API Function Name	Function
Timer	TMPn_Init	Performs initialization necessary to control 16-bit timer/event counter P (TMP) functions.
	TMPn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter P (TMP).
	TMPn_Start	Starts the count for 16-bit timer/event counter P (TMP).
	TMPn_Stop	Ends the count for 16-bit timer/event counter P (TMP).
	TMPn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter P (TMP).
	TMPn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter P (TMP) (high/low level width).
	TMPn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter P (TMP).
	TMPn_ChangeDuty	Changes the duty ratio of the PWM signal.
	TMPn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
	TMQ0_Init	Performs initialization necessary to control 16-bit timer/event counter Q (TMQ) functions.
	TMQ0_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter Q (TMQ).
	TMQ0_Start	Starts the count for 16-bit timer/event counter Q (TMQ).
	TMQ0_Stop	Ends the count for 16-bit timer/event counter Q (TMQ).
	TMQ0_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter Q (TMQ).
	TMQ0_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter Q (TMQ) (high/low level width).
	TMQ0_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter Q (TMQ).
	TMQ0_ChangeDuty	Changes the duty ratio of the PWM signal.
	TMQ0_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
	TAAn_Init	Performs initialization necessary to control 16-bit timer/event counter AA (TAA) functions.
	TAAn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter AA (TAA).
	TAAn_Start	Starts the count for 16-bit timer/event counter AA (TAA).
	TAAn_Stop	Ends the count for 16-bit timer/event counter AA (TAA).
	TAAn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter AA (TAA).
	TAAn_ControlOutputToggle	Changes the toggle control of 16-bit timer/event counter AA (TAA).
	TAAn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter AA (TAA) (high/low level width).
	TAAn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter AA (TAA).
	TAAn_ChangeDuty	Changes the duty ratio of the PWM signal.

Peripheral Function	API Function Name	Function
Timer	TAAn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
	TABn_Init	Performs initialization necessary to control 16-bit timer/ event counter AB (TAB) functions.
	TABn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter AB (TAB).
	TABn_Start	Starts the count for 16-bit timer/event counter AB (TAB).
	TABn_Stop	Ends the count for 16-bit timer/event counter AB (TAB).
	TABn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter AB (TAB).
	TABn_ControlOutputToggle	Changes the toggle control of 16-bit timer/event counter AB (TAB).
	TABn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter AB (TAB) (high/low level width).
	TABn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter AB (TAB).
	TABn_ChangeDuty	Changes the duty ratio of the PWM signal.
	TABn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
	TMT0_Init	Performs initialization necessary to control 16-bit timer/ event counter T (TMT) functions.
	TMT0_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter T (TMT).
	TMT0_Start	Starts the count for 16-bit timer/event counter T (TMT).
	TMT0_Stop	Ends the count for 16-bit timer/event counter T (TMT).
	TMT0_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter T (TMT).
	TMT0_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter T (TMT) (high/low level width).
	TMT0_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter T (TMT).
	TMT0_ChangeDuty	Changes the duty ratio of the PWM signal.
	TMT0_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
	TMT0_EnableHold	Changes the encoder counter control of 16-bit timer/ event counter T (TMT) to holding count value.
	TMT0_DisableHold	Changes the encoder counter control of 16-bit timer/ event counter T (TMT) to normal operation.
	TMT0_ChangeCountValue	Changes the initial counter value for 16-bit timer/event counter T (TMT).
	TMMn_Init	Performs initialization necessary to control 16-bit interval timer M (TMM) functions.
	TMMn_UserInit	Performs user-defined initialization relating to the 16-bit interval timer M (TMM).
	TMMn_Start	Starts the count for 16-bit interval timer M (TMM).
	TMMn_Stop	Ends the count for 16-bit interval timer M (TMM).

Peripheral Function	API Function Name	Function
Timer	TMMn_ChangeTimerCondition	Changes the counter value for 16-bit interval timer M (TMM).
Watch Timer	WT_Init	Performs initialization necessary to control watch timer functions.
	WT_UserInit	Performs user-defined initialization relating to the watch timer.
	WT_Start	Clears the watch timer counter and resumes counting.
	WT_Stop	Ends the count for watch timer.
RTC	RTC_Init	Performs initialization necessary to control real-time counter functions.
	RTC_UserInit	Performs user-defined initialization relating to the real-time counter.
	RTC_CounterEnable	Starts the count of the real-time counter (year, month, weekday, day, hour, minute, second).
	RTC_CounterDisable	Ends the count of the real-time counter (year, month, weekday, day, hour, minute, second).
	RTC_SetHourSystem	Sets the clock type (12-hour or 24-hour clock) of the real-time counter.
	RTC_CounterSet	Sets the counter value (year, month, weekday, day, hour, minute, second) of the real-time counter.
	RTC_CounterGet	Reads the counter value (year, month, weekday, day, hour, minute, second) of the real-time counter.
	RTC_ConstPeriodInterruptEnable	Sets the cycle of the interrupts INTRTC0, then starts the cyclic interrupt function.
	RTC_ConstPeriodInterruptDisable	Ends the cyclic interrupt function.
	RTC_AlarmEnable	Starts the alarm interrupt function.
	RTC_AlarmDisable	Ends the alarm interrupt function.
	RTC_AlarmSet	Sets the alarm conditions (weekday, hour, minute).
	RTC_AlarmGet	Reads the alarm conditions (weekday, hour, minute).
	RTC_IntervalStart	Starts the interval interrupt function.
	RTC_IntervalStop	Ends the interval interrupt function.
	RTC_IntervalInterruptEnable	Sets the cycle of the interrupts INTRTC2, then starts the interval interrupt function.
	RTC_IntervalInterruptDisable	Ends the interval interrupt function.
	RTC_RC1CK1HZ_OutputEnable	Enables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.
	RTC_RC1CK1HZ_OutputDisable	Disables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.
	RTC_RC1CKO_OutputEnable	Enables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.
	RTC_RC1CKO_OutputDisable	Disables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.

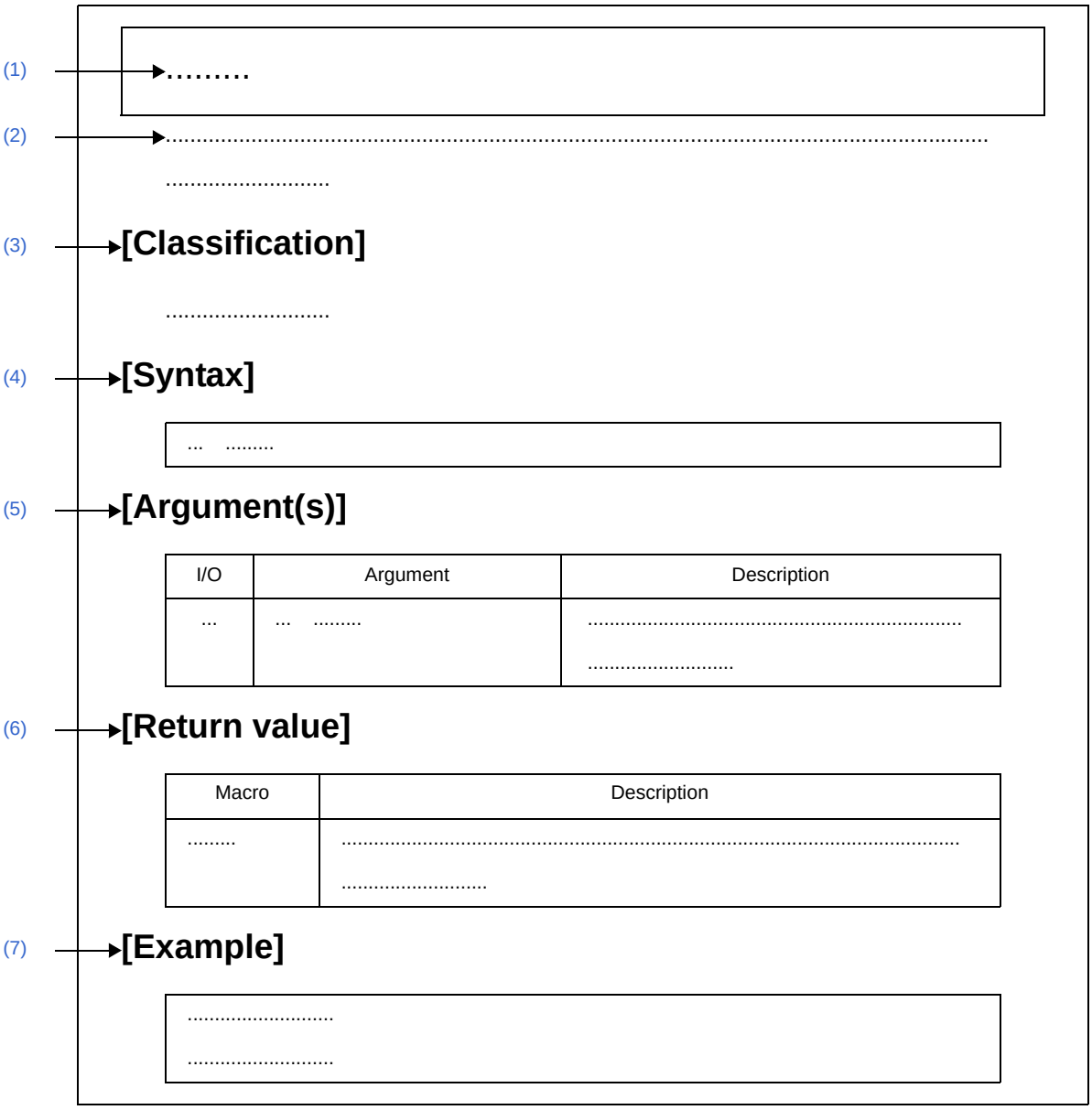
Peripheral Function	API Function Name	Function
RTC	RTC_RC1CKDIV_OutputEnable	Enables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.
	RTC_RC1CKDIV_OutputDisable	Disables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.
	RTC_RTC1HZ_OutputEnable	Enables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.
	RTC_RTC1HZ_OutputDisable	Disables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.
	RTC_RTCCL_OutputEnable	Enables output of the real-time counter clock (32 kHz source) to the RTCCL pin.
	RTC_RTCCL_OutputDisable	Disables output of the real-time counter clock (32 kHz source) to the RTCCL pin.
	RTC_RTCDIV_OutputEnable	Enables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.
	RTC_RTCDIV_OutputDisable	Disables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.
	RTC_ChangeCorrectionValue	Changes the timing and correction value for correcting clock errors.
Real-Time Output	RTOn_Init	Performs initialization necessary to control real-time output functions.
	RTOn_UserInit	Performs user-defined initialization relating to the real-time output.
	RTOn_Enable	Enables (validates) real-time output.
	RTOn_Disable	Disables (invalidates) real-time output.
	RTOn_Set2BitData	Sets 2-bit data for real-time output.
	RTOn_Set4BitData	Sets 4-bit data for real-time output.
	RTOn_Set6BitData	Sets 6-bit data for real-time output.
	RTOn_Set8BitData	Sets 8-bit data for real-time output.
	RTOn_SetHigh2BitData	Sets higher 2-bit data for real-time output.
	RTOn_SetLow2BitData	Sets lower 2-bit data for real-time output.
	RTOn_SetHigh4BitData	Sets higher 4-bit data for real-time output.
	RTOn_SetLow4BitData	Sets lower 4-bit data for real-time output.
	RTOn_GetValue	Reads data from real-time output.
DMA	DMAn_Init	Performs initialization necessary to control DMA controller functions.
	DMAn_UserInit	Performs user-defined initialization relating to the DMA controller.
	DMAn_Enable	Enables operation of channel *n*.
	DMAn_Disable	Disables operation of channel *n*.
	DMAn_CheckStatus	Reads the transfer status (transfer complete/transfer ongoing).

Peripheral Function	API Function Name	Function
DMA	DMAn_SetData	Sets the RAM address of the transfer source/destination, and the number of times the data has been transferred.
	DMAn_SoftwareTriggerOn	Uses a software trigger as a DMA transfer start trigger.
LVI	LVI_Init	Performs initialization necessary to control low-voltage detector functions.
	LVI_UserInit	Performs user-defined initialization relating to the low-voltage detector.
	LVI_InterruptModeStart	Starts low-voltage detection (when in interrupt generation mode).
	LVI_ResetModeStart	Starts low-voltage detection (when in internal reset mode).
	LVI_Start	Starts low-voltage detection.
	LVI_Stop	Stops low-voltage detection.

C.3 Function Reference

This section describes the API functions output by 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) [Classification]

Indicates the name of the C source file to which the API function is output.

(4) [Syntax]

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

(5) [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

(6) [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

(7) [Example]

Shows an example of the API function in use.

C.3.1 System

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

Table C-2. API Functions: [System]

API Function Name	Function
CLOCK_Init	Performs initialization necessary to control clock functions.
CLOCK_UserInit	Performs user-defined initialization relating to the clock.
CG_ReadResetSource	Performs processing in response to a reset signal.
CG_ChangeClockMode	Changes the CPU clock.
CG_ChangeFrequency	Changes the CPU clock division ratio.
CG_SelectPowerSaveMode	Configures the CPU's standby function.
CG_SelectStabTime	Selects the oscillation stabilization time for the X1 oscillator. This will become necessary when STOP mode is released.
CG_SelectPllMode	Selects the operation mode of the PLL function.
CG_SelectSSCGMode	Selects the operation mode of the SSCG (Spread Spectrum Clock Generator).
WDT2_Restart	Clears the watchdog timer counter and resumes counting.
CRC_Start	Begins detection of data-block errors.
CRC_SetData	Sets data in the CRC input register (CRCIN).
CRC_GetResult	Reads the results of the calculation stored in the CRC data register (CRCD).

CLOCK_Init

Performs initialization necessary to control clock functions.

[Classification]

CG_system.c

[Syntax]

```
void    CLOCK_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

CLOCK_UserInit

Performs user-defined initialization relating to the clock.

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

[Classification]

CG_system_user.c

[Syntax]

```
void    CLOCK_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

CG_ReadResetSource

Performs processing in response to a reset signal.

[Classification]

CG_system_user.c

[Syntax]

```
void    CG_ReadResetSource ( void );
```

[Argument(s)]

None.

[Return value]

None.

[Example]

Below are examples of the different processes executing depending on the reset signal trigger.

[CG_Systeminit.c]

```
void systeminit ( void ) {
    CG_ReadResetSource ();  /* Perform process according to reset signal trigger */
    ......
}
```

[CG_system_user.c]

```
#include    "CG_macrodriver.h"
void CG_ReadResetSource ( void ) {
    UCHAR   resetflag = RESF;   /* Reset control flag register: Obtain RESF contents */
    if ( resetflag & 0x1 ) {            /* Trigger identification: Check LVIRF flag */
        ......  /* Process performed when low-voltage detector detects low voltage */
    } else if ( resetflag & 0x2 ) {     /* Trigger identification: Check CLMRF flag */
        ......  /* Process performed when clock monitor oscillation stopped */
    } else if ( resetflag & 0x10 ) {    /* Trigger identification: Check WDT2RF flag */
        ......  /* Process performed when watchdog timer 2 overflows */
    }
    ......
}
```

CG_ChangeClockMode

Changes the CPU clock.

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_ChangeClockMode ( enum ClockMode mode );
```

[Argument(s)]

I/O	Argument	Description
I	`enum ClockMode mode;`	CPU clock type MAINOSCCLK: Main clock oscillator (fXX) SUBCLK: Subclock oscillator (fXT)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR1	Exit with error (abend) - Cannot change from the subclock oscillator (fXT) to the main clock oscillator (fXX).
MD_ERROR2	Exit with error (abend) - Cannot change from the main clock oscillator (fXX) to the subclock oscillator (fXT).
MD_ARGERROR	Invalid argument specification

CG_ChangeFrequency

Changes the CPU clock division ratio.

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_ChangeFrequency ( enum CPUClock clock );
```

[Argument(s)]

I/O	Argument	Description
I	`enum CPUClock clock;`	Division ratio type SYSTEMCLOCK: fxx SYSONEHALF: fxx/2 SYSONEFOURTH: fxx/4 SYSONEEIGHTH: fxx/8 SYSONESIXTEENTH: fxx/16 SYSONETHIRTYSECOND: fxx/32

Remark "fxx" signifies the frequency of the main clock oscillator.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)
MD_ARGERROR	Invalid argument specification

CG_SelectPowerSaveMode

Configures the CPU's standby function.

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_SelectPowerSaveMode ( enum PSLevel level );
```

[Argument(s)]

I/O	Argument	Description
I	`enum PSLevel level;`	Standby function type [E/Sx3-H] [ES/Jx3-E] [ES/Jx3-H] PSSTOP: STOP mode PSHALT: HALT mode PSIDLE1: IDLE1 mode PSIDLE2: IDLE2 mode [ES/Jx3] [ES/Jx3-L] PSSTOP: STOP mode PSHALT: HALT mode

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CG_SelectStabTime

Selects the oscillation stabilization time for the X1 oscillator. This will become necessary when STOP mode is released.

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_SelectStabTime ( enum StabTime waittime );
```

[Argument(s)]

I/O	Argument	Description
I	`enum StabTime waittime;`	Oscillation stabilization time type STLEVEL0: 2^10/fx STLEVEL1: 2^11/fx STLEVEL2: 2^12/fx STLEVEL3: 2^13/fx STLEVEL4: 2^14/fx STLEVEL5: 2^15/fx STLEVEL6: 2^16/fx

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CG_SelectPllMode

Selects the operation mode of the PLL function.

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_SelectPllMode ( enum PllMode pllmode );
```

[Argument(s)]

I/O	Argument	Description
I	`enum PllMode pllmode;`	Operation mode type [E/Sx3-H] [ES/Jx3] [ES/Jx3-L] SYSPLLOFF: Clock-through mode SYS4PLL: x4 (When PLL function is used) SYS8PLL: x8 (When PLL function is used) [ES/Jx3-E] [ES/Jx3-H] SYSPLLOFF: PLL stopped SYSPLLON: PLL operating

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend) [ES/Jx3] [ES/Jx3-E] [ES/Jx3-H] [ES/Jx3-L]
MD_ERROR1	Exit with error (abend) [E/Sx3-H] - Cannot change the operation mode.
MD_ERROR2	Exit with error (abend) [E/Sx3-H] - Cannot change to the x4.
MD_ERROR3	Exit with error (abend) [E/Sx3-H] - Cannot change to the x8.
MD_ARGERROR	Invalid argument specification

CG_SelectSSCGMode

Selects the operation mode of the SSCG (Spread Spectrum Clock Generator).

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_system.h"
MD_STATUS   CG_SelectSSCGMode ( enum SSCGMode sscgmode );
```

[Argument(s)]

I/O	Argument	Description
I	`enum SSCGMode sscgmode;`	Operation mode type SYSSSCGON: SSCG operation enabled SYSSSCGOFF: SSCG operation stopped

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)
MD_ARGERROR	Invalid argument specification

WDT2_Restart

Clears the watchdog timer counter and resumes counting.

[Classification]

CG_system.c

[Syntax]

```
void    WDT2_Restart ( void );
```

[Argument(s)]

None.

[Return value]

None.

CRC_Start

Begins detection of data-block errors.

[Classification]

CG_system.c

[Syntax]

```
void    CRC_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

CRC_SetData

Sets data in the CRC input register (CRCIN).

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    CRC_SetData ( UCHAR data );
```

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	Data to set

[Return value]

None.

CRC_GetResult

Reads the results of the calculation stored in the CRC data register (CRCD).

[Classification]

CG_system.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    CRC_GetResult ( USHORT *result );
```

[Argument(s)]

I/O	Argument	Description
O	`USHORT *result;`	Pointer to area in which to store read calculation results

[Return value]

None.

C.3.2 External Bus

Below is a list of API functions output by Code Generator for external bus interface use.

Table C-3. API Functions: [External Bus]

API Function Name	Function
BUS_Init	Performs initialization necessary to control external bus interface functions (functions to connect an external bus to areas other than onboard ROM, ROM and RAM).
BUS_UserInit	Performs user-defined initialization relating to the external bus interface.

BUS_Init

Performs initialization necessary to control external bus interface functions (functions to connect an external bus to areas other than onboard ROM, ROM and RAM).

[Classification]

CG_bus.c

[Syntax]

```
void    BUS_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

BUS_UserInit

Performs user-defined initialization relating to the external bus interface.

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

[Classification]

CG_bus_user.c

[Syntax]

```
void    BUS_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.3.3 Port

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

Table C-4. API Functions: [Port]

API Function Name	Function
PORT_Init	Performs initialization necessary to control port functions.
PORT_UserInit	Performs user-defined initialization relating to the port.
PORT_ChangePmnInput	Switches the pin's I/O mode from output mode to input mode.
PORT_ChangePmnOutput	Switches the pin's I/O mode from input mode to output mode.

PORT_Init

Performs initialization necessary to control port functions.

[Classification]

CG_port.c

[Syntax]

```
void    PORT_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

PORT_UserInit

Performs user-defined initialization relating to the port.

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

[Classification]

CG_port_user.c

[Syntax]

```
void    PORT_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

PORT_ChangeP*mn*Input

Switches the pin's I/O mode from output mode to input mode.

[Classification]

CG_port.c

[Syntax]

```
void    PORT_ChangeP mn Input ( void );
```

Remark *mn* is the port number.

[Argument(s)]

None.

[Return value]

None.

[Example]

Below is an example of switching the P00 pin's I/O mode from output mode to input mode.

[CG_main.c]

```
void main ( void ) {
    ......
    PORT_ChangeP00Input ( );        /* Switch I/O mode */
    ......
}
```

PORT_ChangeP*mn*Output

Switches the pin's I/O mode from input mode to output mode.

[Classification]

CG_port.c

[Syntax]

The format for specifying this API function differs according to whether the target pin conducts N-ch open drain output.

- [N-ch open drain output: none]

```
#include    "CG_macrodriver.h"
void    PORT_ChangeP mn Output ( BOOL initialvalue );
```

- [N-ch open drain output: yes]

```
#include    "CG_macrodriver.h"
void    PORT_ChangeP mn Output ( BOOL enablench, BOOL initialvalue );
```

Remark *nm* is the port number.

[Argument(s)]

I/O	Argument	Description
I	BOOL *enablench*;	Output mode type MD_TRUE: N-ch open drain output (V_{DD} withstand voltage) mode MD_FALSE: Normal output mode
I	BOOL *initialvalue*;	Initial output value MD_SET: Output HIGH level "1" MD_CLEAR: Output LOW level "0"

[Return value]

None.

[Example 1]

Below is shown an example where pin P00 (N-ch open drain output: none) is changed as follows:

I/O mode type: Output mode
Initial output value: Output HIGH level "1"

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    ......
    PORT_ChangeP00Output ( MD_SET );    /* Switch I/O mode */
```

```
    ......
}
```

[Example 2]

Below is shown an example where pin P04 (N-ch open drain output: yes) is changed as follows:

I/O mode type: Output mode
Output mode type: N-ch open drain output (V_{DD} withstand voltage) mode
Initial output value: Output LOW level "0"

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    ......
    PORT_ChangeP04Output ( MD_TRUE, MD_CLEAR ); /* Switch I/O mode */
    ......
}
```

C.3.4 INT

Below is a list of API functions output by Code Generator for interrupt and key interrupt use.

Table C-5. API Functions: [INT]

API Function Name	Function
INTP_Init	Performs initialization necessary to control the external interrupt INTP*n* functions.
INTP_UserInit	Performs user-defined initialization relating to the external interrupt INTP*n* functions.
KEY_Init	Performs initialization necessary to control the key interrupt INTKR functions.
KEY_UserInit	Performs user-defined initialization relating to the key interrupt INTKR functions.
INT_MaskableInterruptEnable	Disables/enables the acceptance of the maskable interrupts.
INTPn_Disable	Disables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).
INTPn_Enable	Enables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).
KEY_Disable	Disables the acceptance of the key interrupts INTKR.
KEY_Enable	Enables the acceptance of the key interrupts INTKR.

INTP_Init

Performs initialization necessary to control the external interrupt INTP*n* functions.

[Classification]

CG_int.c

[Syntax]

```
void    INTP_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

INTP_UserInit

Performs user-defined initialization relating to the external interrupt INTP*n* functions.

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

[Classification]

CG_int_user.c

[Syntax]

```
void    INTP_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

KEY_Init

Performs initialization necessary to control the key interrupt INTKR functions.

[Classification]

CG_int.c

[Syntax]

```
void    KEY_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

KEY_UserInit

Performs user-defined initialization relating to the key interrupt INTKR functions.

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

[Classification]

CG_int_user.c

[Syntax]

```
void    KEY_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

INT_MaskableInterruptEnable

Disables/enables the acceptance of the maskable interrupts.

[Classification]

CG_int.c

[Syntax]

- [E/Sx3-H] [ES/Jx3-E] [ES/Jx3-H]

```
#include    "CG_macrodriver.h"
#include    "CG_int.h"
MD_STATUS   INT_MaskableInterruptEnable ( enum MaskableSource name, BOOL enableflag );
```

- [ES/Jx3] [ES/Jx3-L]

```
#include    "CG_macrodriver.h"
#include    "CG_int.h"
void    INT_MaskableInterruptEnable ( enum MaskableSource name, BOOL enableflag );
```

[Argument(s)]

I/O	Argument	Description
I	`enum MaskableSource name;`	Maskable interrupt type INT_*xxx*: Maskable interrupt
I	`BOOL enableflag;`	Acceptance enabled/disabled MD_TRUE: Acceptance enabled MD_FALSE: Acceptance disabled

Remark See the header file CG_int.h for details about the maskable interrupt type INT_*xxx*.

[Return value]

- [E/Sx3-H] [ES/Jx3-E] [ES/Jx3-H]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

- [ES/Jx3] [ES/Jx3-L]

None.

[Example 1]

Below is an example of disabling acceptance of the maskable interrupt INTP0.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_int.h"
void main ( void ) {
    ......
    INT_MaskableInterruptEnable ( INT_INTP0, MD_FALSE );  /* Disable acceptance of maskable
interrupt INTP0 */
    ......
}
```

[Example 2]

Below is an example of enabling acceptance of the maskable interrupt INTP0.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_int.h"
void main ( void ) {
    ......
    INT_MaskableInterruptEnable ( INT_INTP0, MD_TRUE );   /* Enable acceptance of maskable
interrupt INTP0 */
    ......
}
```

INTP*n*_Disable

Disables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).

[Classification]

CG_int.c

[Syntax]

```
void    INTPn_Disable ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

INTP*n*_Enable

Enables the acceptance of the maskable interrupts INTP*n* (external interrupt requests).

[Classification]

CG_int.c

[Syntax]

```
void    INTPn_Enable ( void );
```

Remark *n* is the interrupt factor number.

[Argument(s)]

None.

[Return value]

None.

KEY_Disable

Disables the acceptance of the key interrupts INTKR.

[Classification]

CG_int.c

[Syntax]

```
void    KEY_Disable ( void );
```

[Argument(s)]

None.

[Return value]

None.

KEY_Enable

Enables the acceptance of the key interrupts INTKR.

[Classification]

CG_int.c

[Syntax]

```
void    KEY_Enable ( void );
```

[Argument(s)]

None.

[Return value]

None.

C.3.5 Serial

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

Table C-6. API Functions: [Serial]

API Function Name	Function
UARTAn_Init	Performs initialization necessary to control the asynchronous serial interface A (UARTA) functions.
UARTAn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface A (UARTA).
UARTAn_Start	Enables asynchronous serial interface A (UARTA).
UARTAn_Stop	Disables asynchronous serial interface A (UARTA).
UARTAn_SendData	Starts UARTA*n* data transmission.
UARTAn_ReceiveData	Starts UARTA*n* data reception.
UARTAn_SendEndCallback	Performs processing in response to the UARTA*n* consecutive transmission enable interrupt INTUA*n*T.
UARTAn_ReceiveEndCallback	Performs processing in response to the UARTA*n* reception completion interrupt INTUA*n*R.
UARTAn_ErrorCallback	Performs processing in response to the UARTA*n* reception error interrupt INTUA*n*R (overrun error, framing error, parity error).
UARTAn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
UARTBn_Init	Performs initialization necessary to control the asynchronous serial interface B (UARTB) functions.
UARTBn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface B (UARTB).
UARTBn_Start	Enables asynchronous serial interface B (UARTB).
UARTBn_Stop	Disables asynchronous serial interface B (UARTB).
UARTBn_SendData	Starts UARTB*n* data transmission.
UARTBn_ReceiveData	Starts UARTB*n* data reception.
UARTBn_SendEndCallback	Performs processing consequent to the transmission enable interrupt INTUB*n*TIT and the FIFO transmission completion interrupt INTUB*n*TIF.
UARTBn_ReceiveEndCallback	Performs processing in response to the reception completion interrupt INTUB*n*TIR.
UARTBn_SingleErrorCallback	Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).
UARTBn_FIFOErrorCallback	Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).
UARTBn_TimeoutErrorCallback	Performs processing in response to the reception timeout error interrupt INTUB*n*TITO.
UARTBn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
UARTCn_Init	Performs initialization necessary to control the asynchronous serial interface C (UARTC) functions.
UARTCn_UserInit	Performs user-defined initialization relating to the asynchronous serial interface C (UARTC).
UARTCn_Start	Enables asynchronous serial interface C (UARTC).
UARTCn_Stop	Disables asynchronous serial interface C (UARTC).

API Function Name	Function
UARTCn_SendData	Starts UARTC*n* data transmission.
UARTCn_ReceiveData	Starts UARTC*n* data reception.
UARTCn_SendEndCallback	Performs processing in response to the UARTC*n* consecutive transmission enable interrupt INTUC*n*T.
UARTCn_ReceiveEndCallback	Performs processing in response to the UARTC*n* reception completion interrupt INTUC*n*R.
UARTCn_ErrorCallback	Performs processing in response to the UARTC*n* reception error interrupt INTUC*n*R (overrun error, framing error, parity error).
UARTCn_SoftOverRunCallback	Performs processing in response to detection of overrun error.
CSIBn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O B (CSIB) functions.
CSIBn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O B (CSIB).
CSIBn_Start	Enables 3-wire variable-length serial I/O B (CSIB).
CSIBn_Stop	Disables 3-wire variable-length serial I/O B (CSIB).
CSIBn_SendData	Starts CSIB data transmission.
CSIBn_ReceiveData	Starts CSIB data reception.
CSIBn_SendReceiveData	Starts CSIB data transmission/reception.
CSIBn_SendEndCallback	Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R or the CSIB*n* consecutive transmission write enable interrupt INTCB*n*T.
CSIBn_ReceiveEndCallback	Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R.
CSIBn_ErrorCallback	Performs processing in response to the CSIB*n* reception error interrupt INTCB*n*R (overrun error).
CSIEn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O E (CSIE) functions.
CSIEn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O E (CSIE).
CSIEn_Start	Enables 3-wire variable-length serial I/O E (CSIE).
CSIEn_Stop	Disables 3-wire variable-length serial I/O E (CSIE).
CSIEn_SendData	Starts CSIE data transmission.
CSIEn_ReceiveData	Starts CSIE data reception.
CSIEn_SendReceiveData	Starts CSIE data transmission/reception.
CSIEn_SendEndCallback	Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.
CSIEn_ReceiveEndCallback	Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.
CSIEn_ErrorCallback	Performs processing in response to the CSIE*n*BUF overflow interrupt INTCE*n*TIOF.
CSIFn_Init	Performs initialization necessary to control the 3-wire variable-length serial I/O F (CSIF) functions.
CSIFn_UserInit	Performs user-defined initialization relating to the 3-wire variable-length serial I/O F (CSIF).

API Function Name	Function
CSIFn_Start	Enables 3-wire variable-length serial I/O F (CSIF).
CSIFn_Stop	Disables 3-wire variable-length serial I/O F (CSIF).
CSIFn_SendData	Starts CSIF data transmission.
CSIFn_ReceiveData	Starts CSIF data reception.
CSIFn_SendReceiveData	Starts CSIF data transmission/reception.
CSIFn_SendEndCallback	Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.
CSIFn_ReceiveEndCallback	Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.
CSIFn_ErrorCallback	Performs processing in response to the CSIF*n* reception error interrupt INTCF*n*R (overrun error).
IIC0n_Init	Performs initialization necessary to control the IIC bus functions.
IIC0n_UserInit	Performs user-defined initialization relating to the IIC bus.
IIC0n_Stop	Ends IIC0*n* communication.
IIC0n_StopCondition	Generates a stop condition.
IIC0n_MasterSendStart	Starts IIC0*n* master transmission.
IIC0n_MasterReceiveStart	Starts IIC0*n* master reception.
IIC0n_MasterSendEndCallback	Performs processing in response to the IIC0*n* master transfer completion interrupt INTIIC*n*.
IIC0n_MasterReceiveEndCallback	Performs processing in response to the IIC0*n* master transfer completion interrupt INTIIC*n*.
IIC0n_MasterErrorCallback	Performs processing in response to detection of error in IIC0*n* master communication.
IIC0n_SlaveSendStart	Starts IIC0*n* slave transmission.
IIC0n_SlaveReceiveStart	Starts IIC0*n* slave reception.
IIC0n_SlaveSendEndCallback	Performs processing in response to the IIC0*n* slave transfer completion interrupt INTIIC*n*.
IIC0n_SlaveReceiveEndCallback	Performs processing in response to the IIC0*n* slave transfer completion interrupt INTIIC*n*.
IIC0n_SlaveErrorCallback	Performs processing in response to detection of error in IIC0*n* slave communication.
IIC0n_GetStopConditionCallback	Performs processing in response to detection of stop condition.

UARTA*n*_Init

Performs initialization necessary to control the asynchronous serial interface A (UARTA) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    UARTAn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_UserInit

Performs user-defined initialization relating to the asynchronous serial interface A (UARTA).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTAn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_Start

Enables asynchronous serial interface A (UARTA).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTAn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_Stop

Disables asynchronous serial interface A (UARTA).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTAn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_SendData

Starts UARTA*n* data transmission.

Remarks 1. This API function repeats the byte-level UARTA*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a UARTA*n* transmission, UARTAn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTAn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *txbuf;	Pointer to a buffer storing the transmission data
I	USHORT txnum;	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification
MD_DATAEXISTS	Exit with error (abend) - Hold a next transmission data in the UA*n*TX register.

UARTA*n*_ReceiveData

Starts UARTA*n* data reception.

Remarks 1. This API function performs byte-level UARTA*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. Actual UARTA*n* reception starts after this API function is called, and UARTAn_Start is then called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTAn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *rxbuf;`	Pointer to a buffer to store the received data
I	`USHORT rxnum;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

UARTA*n*_SendEndCallback

Performs processing in response to the UARTA*n* consecutive transmission enable interrupt INTUA*n*T.

Remark This API function is called as the callback routine of interrupt process MD_INTUA*n*T corresponding to the UARTA*n* consecutive transmission enable interrupt INTUA*n*T (performed when total number of UARTA*n* transmissions specified by UARTAn_SendData parameter *txnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTAn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_ReceiveEndCallback

Performs processing in response to the UARTA*n* reception completion interrupt INTUA*n*R.

Remark This API function is called as the callback routine of interrupt process MD_INTUA*n*R corresponding to the UARTA*n* reception completion interrupt INTUA*n*R (performed when total number of UARTA*n* receptions specified by UARTAn_ReceiveData parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTAn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTA*n*_ErrorCallback

Performs processing in response to the UARTA*n* reception error interrupt INTUA*n*R (overrun error, framing error, parity error).

Remark This API function is called as the callback routine of interrupt process MD_INTUA*n*R corresponding to the UARTA*n* reception error interrupt INTUA*n*R.

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTAn_ErrorCallback ( UCHAR err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR err_type;`	Trigger for UARTA*n* reception error interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Framing error 000001*xx*B: Parity error

[Return value]

None.

UARTA*n*_SoftOverRunCallback

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process MD_INTUA*n*R corresponding to the UARTA*n* reception error interrupt INTUA*n*R (process performed when the amount of data received is greater than the parameter *rxnum* specified for UARTAn_ReceiveData).

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTAn_SoftOverRunCallback ( UCHAR rx_data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR rx_data;`	Received data

[Return value]

None.

UARTB*n*_Init

Performs initialization necessary to control the asynchronous serial interface B (UARTB) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    UARTBn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_UserInit

Performs user-defined initialization relating to the asynchronous serial interface B (UARTB).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTBn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_Start

Enables asynchronous serial interface B (UARTB).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTBn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_Stop

Disables asynchronous serial interface B (UARTB).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTBn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_SendData

Starts UARTB*n* data transmission.

Remarks 1. This API function repeats the byte-level UARTB*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a UARTB*n* transmission (single mode), UARTBn_Start must be called before this API function is called.

3. When performing a UARTB*n* transmission (FIFO mode), UARTBn_Start must be called after this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTBn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR *txbuf;`	Pointer to a buffer storing the transmission data
I	`USHORT txnum;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification - *txnum*is not a multiple of transmit FIFO as trigger.
MD_DATAEXISTS	Exit with error (abend) - Hold a next transmission data in the UB*n*TX register.

UARTB*n*_ReceiveData

Starts UARTB*n* data reception.

Remarks 1. This API function performs byte-level UARTB*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. Actual UARTB*n* reception starts after this API function is called, and UARTBn_Start is then called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTBn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	UCHAR *rxbuf;	Pointer to a buffer to store the received data
I	USHORT rxnum;	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification - *rxnum*is not a multiple of receive FIFO as trigger.

UARTB*n*_SendEndCallback

Performs processing consequent to the transmission enable interrupt INTUB*n*TIT and the FIFO transmission completion interrupt INTUB*n*TIF.

Remark This API function is called as a callback routine of the interrupt process MD_INTUB*n*TIT corresponding to a transmission enable interrupt INTUB*n*TIT of UARTB*n* (single mode), and interrupt process MD_INTUB*n*TIF corresponding to a FIFO transmission completion interrupt INTUB*n*TIF of UARTB*n* (FIFO mode) (performed when total number of UARTB*n* transmissions specified by UARTBn_SendData parameter *txnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTBn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_ReceiveEndCallback

Performs processing in response to the reception completion interrupt INTUB*n*TIR.

Remark This API function is called as the callback routine of interrupt process MD_INTUB*n*TIR corresponding to the reception completion interrupt INTUB*n*TIR (performed when total number of UARTB*n* receptions specified by UARTBn_ReceiveData parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTBn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_SingleErrorCallback

Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).

Remark This API function is called as a callback routine of the interrupt process MD_INTUB*n*TIRE corresponding to a reception error interrupt INTUBA*n*TIRE of UARTB*n* (single mode).

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTBn_SingleErrorCallback ( UCHAR err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR err_type;`	Trigger for reception error interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Framing error 000001*xx*B: Parity error

[Return value]

None.

UARTB*n*_FIFOErrorCallback

Performs processing in response to the reception error interrupt INTUB*n*TIRE (overrun error, framing error, parity error).

Remark This API function is called as a callback routine of the interrupt process MD_INTUB*n*TIRE corresponding to a reception error interrupt INTUBA*n*TIRE of UARTB*n* (FIFO mode).

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTBn_FIFOErrorCallback ( UCHAR err_type1, UCHAR err_type2 );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR err_type1;`	Trigger for reception error interrupt 00001000B: Overrun error
O	`UCHAR err_type2;`	Trigger for reception error interrupt 000000*x*1B: Framing error 0000001*x*B: Parity error

[Return value]

None.

UARTB*n*_TimeoutErrorCallback

Performs processing in response to the reception timeout error interrupt INTUB*n*TITO.

Remark This API function is called as a callback routine of the interrupt process MD_INTUB*n*TITO corresponding to a reception timeout interrupt INTUBA*n*TITO of UARTB*n* (FIFO mode).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTBn_TimeoutErrorCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTB*n*_SoftOverRunCallback

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process MD_INTUB*n*TIRE corresponding to the reception error interrupt INTUB*n*TIRE (process performed when the amount of data received is greater than the parameter *rxnum* specified for UARTBn_ReceiveData).

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTBn_SoftOverRunCallback ( UCHAR rx_data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR rx_data;`	Received data

[Return value]

None.

UARTC*n*_Init

Performs initialization necessary to control the asynchronous serial interface C (UARTC) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    UARTCn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_UserInit

Performs user-defined initialization relating to the asynchronous serial interface C (UARTC).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTCn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_Start

Enables asynchronous serial interface C (UARTC).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTCn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_Stop

Disables asynchronous serial interface C (UARTC).

[Classification]

CG_serial.c

[Syntax]

```
void    UARTCn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_SendData

Starts UARTC*n* data transmission.

Remarks 1. This API function repeats the byte-level UARTC*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a UARTC*n* transmission, UARTCn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTCn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR *txbuf;`	Pointer to a buffer storing the transmission data
I	`USHORT txnum;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification
MD_DATAEXISTS	Exit with error (abend) - Hold a next transmission data in the UC*n*TX register.

UARTC*n*_ReceiveData

Starts UARTC*n* data reception.

Remarks 1. This API function performs byte-level UARTC*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. Actual UARTC*n* reception starts after this API function is called, and UARTCn_Start is then called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   UARTCn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *rxbuf;`	Pointer to a buffer to store the received data
I	`USHORT rxnum;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

UARTC*n*_SendEndCallback

Performs processing in response to the UARTC*n* consecutive transmission enable interrupt INTUC*n*T.

Remark This API function is called as the callback routine of interrupt process MD_INTUC*n*T corresponding to the UARTC*n* consecutive transmission enable interrupt INTUC*n*T (performed when total number of UARTC*n* transmissions specified by UARTCn_SendData parameter *txnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTCn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_ReceiveEndCallback

Performs processing in response to the UARTC*n* reception completion interrupt INTUC*n*R.

Remark This API function is called as the callback routine of interrupt process MD_INTUC*n*R corresponding to the UARTC*n* reception completion interrupt INTUC*n*R (performed when total number of UARTC*n* receptions specified by UARTCn_ReceiveData parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    UARTCn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

UARTC*n*_ErrorCallback

Performs processing in response to the UARTC*n* reception error interrupt INTUC*n*R (overrun error, framing error, parity error).

Remark This API function is called as the callback routine of interrupt process MD_INTUC*n*R corresponding to the UARTC*n* reception error interrupt INTUC*n*R.

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTCn_ErrorCallback ( UCHAR err_type );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR err_type;`	Trigger for UARTC*n* reception error interrupt 00000*xx*1B: Overrun error 00000*x*1*x*B: Framing error 000001*xx*B: Parity error

[Return value]

None.

UARTC*n*_SoftOverRunCallback

Performs processing in response to detection of overrun error.

Remark This API function is called as the callback routine of interrupt process MD_INTUC*n*R corresponding to the UARTC*n* reception error interrupt INTUC*n*R (process performed when the amount of data received is greater than the parameter *rxnum* specified for UARTCn_ReceiveData).

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    UARTCn_SoftOverRunCallback ( UCHAR rx_data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR rx_data;`	Received data

[Return value]

None.

CSIB*n*_Init

Performs initialization necessary to control the 3-wire variable-length serial I/O B (CSIB) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    CSIBn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_UserInit

Performs user-defined initialization relating to the 3-wire variable-length serial I/O B (CSIB).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIBn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_Start

Enables 3-wire variable-length serial I/O B (CSIB).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIBn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_Stop

Disables 3-wire variable-length serial I/O B (CSIB).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIBn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_SendData

Starts CSIB*n* data transmission.

Remarks 1. This API function repeats the byte-level CSIB*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a CSIB*n* transmission, CSIBn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIBn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR *txbuf;`	Pointer to a buffer storing the transmission data
I	`USHORT txnum;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIB*n*_ReceiveData

Starts CSIB*n* data reception.

Remarks 1. This API function performs byte-level CSIB*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. When performing a CSIB*n* reception, CSIBn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIBn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	UCHAR *rxbuf;	Pointer to a buffer to store the received data
I	USHORT rxnum;	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIB*n*_SendReceiveData

Starts CSIB*n* data transmission/reception.

Remarks 1. This API function repeats the byte-level CSIB*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. This API function performs byte-level CSIB*n* reception the number of times specified by the parameter *txnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

3. When performing a CSIB*n* transmission/reception, CSIBn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIBn_SendReceiveData ( UCHAR *txbuf, USHORT txnum, UCHAR *rxbuf );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *txbuf;`	Pointer to a buffer to store the received data
I	`USHORT txnum;`	Total amount of data to receive
I	`UCHAR *rxbuf;`	Pointer to a buffer storing the transmission data

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIB*n*_SendEndCallback

Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R or the CSIB*n* consecutive transmission write enable interrupt INTCB*n*T.

Remark This API function is called as the callback routine (process performed when the total number of CSIB*n* transmissions specified in the parameter *txnum* for CSIBn_SendData or CSIBn_SendReceiveData has been completed) of interrupt process MD_INTCB*n*R corresponding to the CSIB*n* reception completion interrupt INTCB*n*R, and interrupt process MD_INTCB*n*T corresponding to the CSIB*n* consecutive transmission write enable interrupt INTCB*n*T.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIBn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_ReceiveEndCallback

Performs processing in response to the CSIB*n* reception completion interrupt INTCB*n*R.

Remark This API function is called as the callback routine (process performed when the total number of CSIB*n* receptions specified in the parameter *rxnum* for CSIBn_ReceiveData or CSIBn_SendReceiveData has been completed) of interrupt process MD_INTCB*n*R corresponding to the CSIB*n* reception completion interrupt INTCB*n*R.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIBn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIB*n*_ErrorCallback

Performs processing in response to the CSIB*n* reception error interrupt INTCB*n*R (overrun error).

Remark This API function is called as the callback routine of interrupt process MD_INTCB*n*R corresponding to the CSIB*n* reception error interrupt INTCB*n*R.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIBn_ErrorCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_Init

Performs initialization necessary to control the 3-wire variable-length serial I/O E (CSIE) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    CSIEn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_UserInit

Performs user-defined initialization relating to the 3-wire variable-length serial I/O E (CSIE).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIEn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_Start

Enables 3-wire variable-length serial I/O E (CSIE).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIEn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_Stop

Disables 3-wire variable-length serial I/O E (CSIE).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIEn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_SendData

Starts CSIE*n* data transmission.

Remarks 1. This API function repeats the byte-level CSIE*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a CSIE*n* transmission, CSIEn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIEn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *txbuf;	Pointer to a buffer storing the transmission data
I	USHORT txnum;	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIE*n*_ReceiveData

Starts CSIE*n* data reception.

Remarks 1. This API function performs byte-level CSIE*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. When performing a CSIE*n* reception, CSIEn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIEn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	UCHAR *rxbuf;	Pointer to a buffer to store the received data
I	USHORT rxnum;	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIE*n*_SendReceiveData

Starts CSIE*n* data transmission/reception.

Remarks 1. This API function repeats the byte-level CSIE*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. This API function performs byte-level CSIE*n* reception the number of times specified by the parameter *txnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

3. When performing a CSIE*n* transmission/reception, CSIEn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIEn_SendReceiveData ( UCHAR *txbuf, USHORT txnum, UCHAR *rxbuf );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *txbuf;`	Pointer to a buffer to store the received data
I	`USHORT txnum;`	Total amount of data to receive
I	`UCHAR *rxbuf;`	Pointer to a buffer storing the transmission data

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIE*n*_SendEndCallback

Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.

Remark This API function is called as the callback routine (process performed when the total number of CSIE*n* transmissions specified in the parameter *txnum* for CSIEn_SendData or CSIEn_SendReceiveData has been completed) of interrupt process MD_INTCE*n*T corresponding to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIEn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_ReceiveEndCallback

Performs processing in response to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.

Remark This API function is called as the callback routine (process performed when the total number of CSIE*n* receptions specified in the parameter *rxnum* for CSIEn_ReceiveData or CSIEn_SendReceiveData has been completed) of interrupt process MD_INTCE*n*T corresponding to the CSIE*n* transmission/reception completion interrupt INTCE*n*T.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIEn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIE*n*_ErrorCallback

Performs processing in response to the CSIE*n*BUF overflow interrupt INTCE*n*TIOF.

Remark This API function is called as the callback routine of interrupt process MD_INTCE*n*TIOF corresponding to the CSIE*n*BUF overflow interrupt INTCE*n*TIOF.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIEn_ErrorCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_Init

Performs initialization necessary to control the 3-wire variable-length serial I/O F (CSIF) functions.

[Classification]

CG_serial.c

[Syntax]

```
void    CSIFn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_UserInit

Performs user-defined initialization relating to the 3-wire variable-length serial I/O F (CSIF).

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

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIFn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_Start

Enables 3-wire variable-length serial I/O F (CSIF).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIFn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_Stop

Disables 3-wire variable-length serial I/O F (CSIF).

[Classification]

CG_serial.c

[Syntax]

```
void    CSIFn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_SendData

Starts CSIF*n* data transmission.

Remarks 1. This API function repeats the byte-level CSIF*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. When performing a CSIF*n* transmission, CSIFn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIFn_SendData ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR *txbuf;`	Pointer to a buffer storing the transmission data
I	`USHORT txnum;`	Total amount of data to send

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIF*n*_ReceiveData

Starts CSIF*n* data reception.

Remarks 1. This API function performs byte-level CSIF*n* reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

2. When performing a CSIF*n* reception, CSIFn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIFn_ReceiveData ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *rxbuf;`	Pointer to a buffer to store the received data
I	`USHORT rxnum;`	Total amount of data to receive

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIF*n*_SendReceiveData

Starts CSIF*n* data transmission/reception.

Remarks 1. This API function repeats the byte-level CSIF*n* transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

2. This API function performs byte-level CSIF*n* reception the number of times specified by the parameter *txnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

3. When performing a CSIF*n* transmission/reception, CSIFn_Start must be called before this API function is called.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   CSIFn_SendReceiveData ( UCHAR *txbuf, USHORT txnum, UCHAR *rxbuf );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *txbuf;`	Pointer to a buffer to store the received data
I	`USHORT txnum;`	Total amount of data to receive
I	`UCHAR *rxbuf;`	Pointer to a buffer storing the transmission data

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

CSIF*n*_SendEndCallback

Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.

Remark This API function is called as the callback routine (process performed when the total number of CSIF*n* transmissions specified in the parameter *txnum* for CSIFn_SendData or CSIFn_SendReceiveData has been completed) of interrupt process MD_INTCF*n*T corresponding to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIFn_SendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_ReceiveEndCallback

Performs processing in response to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.

Remark This API function is called as the callback routine (process performed when the total number of CSIF*n* receptions specified in the parameter *rxnum* for CSIFn_ReceiveData or CSIFn_SendReceiveData has been completed) of interrupt process MD_INTCF*n*T corresponding to the CSIF*n* transmission/reception completion interrupt INTCF*n*T.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIFn_ReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

CSIF*n*_ErrorCallback

Performs processing in response to the CSIF*n* reception error interrupt INTCF*n*R (overrun error).

Remark This API function is called as the callback routine of interrupt process MD_INTCF*n*R corresponding to the CSIF*n* reception error interrupt INTCF*n*R.

[Classification]

CG_serial_user.c

[Syntax]

```
void    CSIFn_ErrorCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_Init

Performs initialization necessary to control the IIC bus functions.

[Classification]

CG_serial.c

[Syntax]

```
void    IIC0n_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_UserInit

Performs user-defined initialization relating to the IIC bus.

Remark This API function is called as the IIC0n_Init callback routine.

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_Stop

Ends IIC0*n* communication.

[Classification]

CG_serial.c

[Syntax]

```
void    IIC0n_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_StopCondition

Generates a stop condition.

[Classification]

CG_serial.c

[Syntax]

```
void    IIC0n_StopCondition ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_MasterSendStart

Starts IIC0*n* master transmission.

Remark This API function repeats the byte-level IIC0*n* master transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

[Classification]

CG_serial.c

[Syntax]

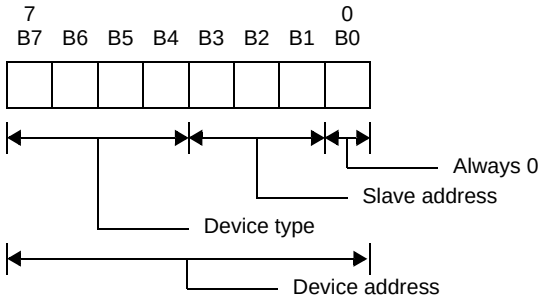
```
#include    "CG_macrodriver.h"
MD_STATUS   IIC0n_MasterSendStart ( UCHAR adr, UCHAR *txbuf, USHORT txnum, UCHAR wait );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *adr*;	Device address
I	UCHAR **txbuf*;	Pointer to a buffer storing the transmission data
I	USHORT *txnum*;	Total amount of data to send
I	UCHAR *wait*;	Setup time of start conditions

Remark Device address *adr* consists of a device type and slave address.



[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)

IIC0*n*_MasterReceiveStart

Starts IIC0*n* master reception.

Remark This API function performs byte-level simple IIC0*n* master reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

[Classification]

CG_serial.c

[Syntax]

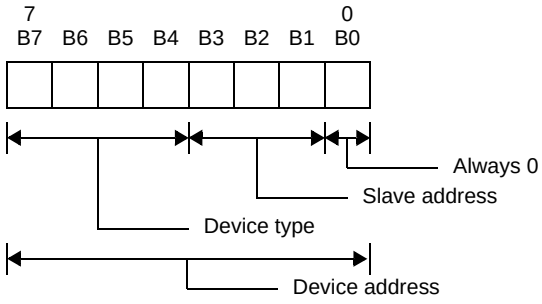
```
#include    "CG_macrodriver.h"
MD_STATUS   IIC0n_MasterReceiveStart ( UCHAR adr, UCHAR *rxbuf, USHORT rxnum, UCHAR wait );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *adr*;	Device address
O	UCHAR **rxbuf*;	Pointer to a buffer to store the received data
I	USHORT *rxnum*;	Total amount of data to receive
I	UCHAR *wait*;	Setup time of start conditions

Remark Device address *adr* consists of a device type and slave address.



[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)

IIC0*n*_MasterSendEndCallback

Performs processing in response to the IIC0*n* master transfer completion interrupt INTIIC*n*.

Remark This API function is called as the callback routine of interrupt process MD_INTIIC*n* corresponding to the simple IIC0*n* master transfer completion interrupt INTIIC*n* (performed when total number of simple IIC0*n* master transmissions specified by IIC0n_MasterSendStart parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_MasterSendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_MasterReceiveEndCallback

Performs processing in response to the IIC0*n* master transfer completion interrupt INTIIC*n*.

Remark This API function is called as the callback routine of interrupt process MD_INTIIC*n* corresponding to the simple IIC0*n* master transfer completion interrupt INTIIC*n* (performed when total number of simple IIC0*n* master transmissions specified by IIC0n_MasterReceiveStart parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_MasterReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_MasterErrorCallback

Performs processing in response to detection of error in IIC0*n* master communication.

Remark This API function is called as the callback routine (process carried out when an IIC0*n* master communication error is detected) of interrupt process MD_INTIIC*n* corresponding to the IIC0*n* master transfer complete interrupt INTIIC*n*.

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    IIC0n_MasterErrorCallback ( MD_STATUS flag );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`MD_STATUS flag;`	Cause of IIC0*n* master communication error MD_SPT: Stop condition detected MD_NACK: Acknowledge detected

[Return value]

None.

IIC0*n*_SlaveSendStart

Starts IIC0*n* slave transmission.

Remark This API function repeats the byte-level IIC0*n* slave transmission from the buffer specified in parameter *txbuf* the number of times specified in parameter *txnum*.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    IIC0n_SlaveSendStart ( UCHAR *txbuf, USHORT txnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR *txbuf;`	Pointer to a buffer storing the transmission data
I	`USHORT txnum;`	Total amount of data to send

[Return value]

None.

IIC0*n*_SlaveReceiveStart

Starts IIC0*n* slave reception.

Remark This API function performs byte-level IIC0*n* slave reception the number of times specified by the parameter *rxnum*, and stores the data in the buffer specified by the parameter *rxbuf*.

[Classification]

CG_serial.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    IIC0n_SlaveReceiveStart ( UCHAR *rxbuf, USHORT rxnum );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *rxbuf;`	Pointer to a buffer to store the received data
I	`USHORT rxnum;`	Total amount of data to receive

[Return value]

None.

IIC0*n*_SlaveSendEndCallback

Performs processing in response to the IIC0*n* slave transfer completion interrupt INTIIC*n*.

Remark This API function is called as the callback routine of interrupt process MD_INTIIC*n* corresponding to the simple IIC0*n* slave transfer completion interrupt INTIIC*n* (performed when total number of simple IIC0*n* slave transmissions specified by IIC0n_SlaveSendStart parameter *txnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_SlaveSendEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_SlaveReceiveEndCallback

Performs processing in response to the IIC0*n* slave transfer completion interrupt INTIIC*n*.

Remark This API function is called as the callback routine of interrupt process MD_INTIIC*n* corresponding to the simple IIC0*n* slave transfer completion interrupt INTIIC*n* (performed when total number of simple IIC0*n* slave transmissions specified by IIC0n_SlaveReceiveStart parameter *rxnum* has been completed).

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_SlaveReceiveEndCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

IIC0*n*_SlaveErrorCallback

Performs processing in response to detection of error in IIC0*n* slave communication.

Remark This API function is called as the callback routine (process carried out when an IIC0*n* slave communication error is detected) of interrupt process MD_INTIIC*n* corresponding to the IIC0*n* slave transfer complete interrupt INTIIC*n*.

[Classification]

CG_serial_user.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    IIC0n_SlaveErrorCallback ( MD_STATUS flag );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`MD_STATUS flag;`	Cause of IIC0*n* master communication error MD_ERROR: Address mismatch deteced MD_NACK: Acknowledge detected

[Return value]

None.

IIC0*n*_GetStopConditionCallback

Performs processing in response to detection of stop condition.

Remark This API function is called as the callback routine (process carried out when a stop condition is detected) of interrupt process MD_INTIIC*n* corresponding to the IIC0*n* transfer completion interrupt INTIIC*n*.

[Classification]

CG_serial_user.c

[Syntax]

```
void    IIC0n_GetStopConditionCallback ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

C.3.6 A/D

Below is a list of API functions output by Code Generator for D/A converter use.

Table C-7. API Functions: [A/D]

API Function Name	Function
AD_Init	Performs initialization necessary to control A/D converter functions.
AD_UserInit	Performs user-defined initialization relating to the A/D converter.
AD_Start	Starts A/D conversion.
AD_Stop	Ends A/D conversion.
AD_SelectADChannel	Configures the analog voltage input pin for A/D conversion.
AD_SetPFTCondition	Sets the information for operation in power-fail compare mode (comparison value and A/D conversion end interrupt INTAD trigger).
AD_Read	Reads the results of A/D conversion (10 bits).
AD_ReadByte	Reads the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution).

AD_Init

Performs initialization necessary to control A/D converter functions.

[Classification]

CG_ad.c

[Syntax]

```
void    AD_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

AD_UserInit

Performs user-defined initialization relating to the A/D converter.

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

[Classification]

CG_ad_user.c

[Syntax]

```
void    AD_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

AD_Start

Starts A/D conversion.

Remark A/D conversion is performed repeatedly between the call to this API function and a call to AD_Stop.

[Classification]

CG_ad.c

[Syntax]

```
void    AD_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

[Example]

The example below shows A/D conversion of analog voltage.

[CG_main.c]

```
#include    "CG_macrodriver.h"
BOOL    gFlag;                          /* A/D conversion complete flag */
void main ( void ) {
    USHORT  buffer = 0;
    int     wait = 100;
    gFlag = 1;                          /* Initialize A/D conversion complete flag */
    ......
    AD_Start ();                        /* Start A/D conversion */
    while ( gFlag );                    /* Wait for INTAD */
    AD_Read ( &buffer );                /* Read results of A/D conversion */
    AD_Stop ();                         /* End A/D conversion */
    ......
}
```

[CG_ad_user.c]

```
#include    "CG_macrodriver.h"
extern  BOOL    gFlag;                  /* A/D conversion complete flag */
__interrupt void MD_INTAD ( void ) {    /* Interrupt processing for INTAD */
    gFlag = 0;                          /* Set A/D conversion complete flag */
}
```

AD_Stop

Ends A/D conversion.

[Classification]

CG_ad.c

[Syntax]

```
void    AD_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

AD_SelectADChannel

Configures the analog voltage input pin for A/D conversion.

[Classification]

CG_ad.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_ad.h"
MD_STATUS   AD_SelectADChannel ( enum ADChannel channel );
```

[Argument(s)]

I/O	Argument	Description
I	`enum ADChannel channel;`	Analog voltage input pin ADCHANNEL*n*: Input pin

Remark See the header file CG_ad.h for details about the analog voltage input pin ADCHANNEL*n*.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

AD_SetPFTCondition

Sets the information for operation in power-fail compare mode (comparison value and A/D conversion end interrupt INTAD trigger).

[Classification]

CG_ad.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_ad.h"
MD_STATUS   AD_SetPFTCondition ( UCHAR pftvalue, enum ADPFTMode mode );
```

[Argument(s)]

I/O	Argument	Description
I	`UCHAR pftvalue;`	Comparison value
I	`enum ADPFTMode mode;`	Cause of A/D conversion end interrupt INTAD EACHEND: Generate INTAD when A/D is complete PFTHIGHER: Generate INTAD if ADA0CRnH ≥ ADA0PFT PFTLOWER: Generate INTAD if ADA0CRnH < ADA0PFT

Remark If the parameter *mode* is set to PFTHIGHER or PFTLOWER, then the value set in parameter *pftvalue* is set in the power-fail compare threshold value register (ADA0PFT), and used for comparison with the A/D conversion result register*n*H (ADA0CR*n*H).

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

AD_Read

Reads the results of A/D conversion (10 bits).

[Classification]

CG_ad.c

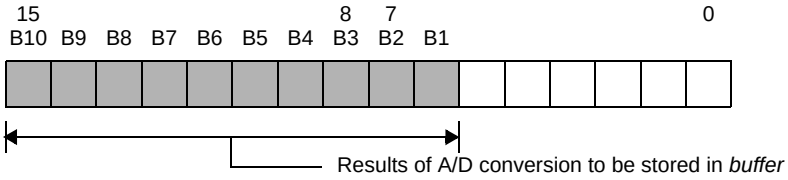
[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   AD_Read ( USHORT *buffer );
```

[Argument(s)]

I/O	Argument	Description
O	`USHORT *buffer;`	Pointer to area in which to store read results of A/D conversion (10 bits)

Remark Below is an example of the results of A/D conversion to be stored in *buffer*.



[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)

AD_ReadByte

Reads the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution).

[Classification]

CG_ad.c

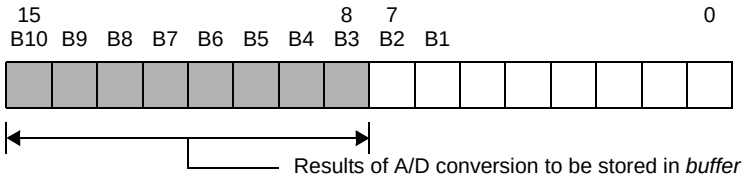
[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   AD_ReadByte ( UCHAR *buffer );
```

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *buffer;`	Pointer to area in which to store the results of A/D conversion (8 bits; most significant 8 bits of 10-bit resolution)

Remark Below is an example of the results of A/D conversion to be stored in *buffer*.



[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend)

C.3.7 D/A

Below is a list of API functions output by Code Generator for D/A converter use.

Table C-8. API Functions: [D/A]

API Function Name	Function
DAn_Init	Performs initialization necessary to control D/A converter functions.
DAn_UserInit	Performs user-defined initialization relating to the D/A converter.
DAn_Start	Starts D/A conversion.
DAn_Stop	Ends D/A conversion.
DAn_SetValue	Sets the analog voltage output to the ANO*n* pin.

DA*n*_Init

Performs initialization necessary to control D/A converter functions.

[Classification]

CG_da.c

[Syntax]

```
void    DAn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DA*n*_UserInit

Performs user-defined initialization relating to the D/A converter.

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

[Classification]

CG_da_user.c

[Syntax]

```
void    DAn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DA*n*_Start

Starts D/A conversion.

[Classification]

CG_da.c

[Syntax]

```
void    DAn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DA*n*_Stop

Ends D/A conversion.

[Classification]

CG_da.c

[Syntax]

```
void    DAn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DA*n*_SetValue

Sets the analog voltage output to the ANO*n* pin.

[Classification]

CG_da.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    DAn_SetValue ( UCHAR value );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *value*;	Analog voltage (0x0 to 0xff)

[Return value]

None.

[Example]

Below is an example of setting "analog voltage" to channels 0 and 1

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    ......
    DA0_Start ();                       /* Start D/A conversion */
    DA1_Start ();                       /* Start D/A conversion */
    ......
    DA0_SetValue ( 0x7f );              /* Set analog voltage */
    ......
}
```

[CG_tau_user.c]

```
#include    "CG_macrodriver.h"
UCHAR   gValue = 0;
__interrupt void MD_INTTM05 ( void ) {  /* Interrupt processing for INTTM05 */
    DA1_SetValue ( gValue++ );          /* Set analog voltage */
}
```

C.3.8 Timer

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

Table C-9. API Functions: [Timer]

API Function Name	Function
TMPn_Init	Performs initialization necessary to control 16-bit timer/event counter P (TMP) functions.
TMPn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter P (TMP).
TMPn_Start	Starts the count for 16-bit timer/event counter P (TMP).
TMPn_Stop	Ends the count for 16-bit timer/event counter P (TMP).
TMPn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter P (TMP).
TMPn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter P (TMP) (high/low level width).
TMPn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter P (TMP).
TMPn_ChangeDuty	Changes the duty ratio of the PWM signal.
TMPn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
TMQ0_Init	Performs initialization necessary to control 16-bit timer/event counter Q (TMQ) functions.
TMQ0_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter Q (TMQ).
TMQ0_Start	Starts the count for 16-bit timer/event counter Q (TMQ).
TMQ0_Stop	Ends the count for 16-bit timer/event counter Q (TMQ).
TMQ0_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter Q (TMQ).
TMQ0_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter Q (TMQ) (high/low level width).
TMQ0_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter Q (TMQ).
TMQ0_ChangeDuty	Changes the duty ratio of the PWM signal.
TMQ0_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
TAAn_Init	Performs initialization necessary to control 16-bit timer/event counter AA (TAA) functions.
TAAn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter AA (TAA).
TAAn_Start	Starts the count for 16-bit timer/event counter AA (TAA).
TAAn_Stop	Ends the count for 16-bit timer/event counter AA (TAA).
TAAn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter AA (TAA).
TAAn_ControlOutputToggle	Changes the toggle control of 16-bit timer/event counter AA (TAA).
TAAn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter AA (TAA) (high/low level width).
TAAn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter AA (TAA).
TAAn_ChangeDuty	Changes the duty ratio of the PWM signal.
TAAn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
TABn_Init	Performs initialization necessary to control 16-bit timer/event counter AB (TAB) functions.
TABn_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter AB (TAB).
TABn_Start	Starts the count for 16-bit timer/event counter AB (TAB).

API Function Name	Function
TABn_Stop	Ends the count for 16-bit timer/event counter AB (TAB).
TABn_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter AB (TAB).
TABn_ControlOutputToggle	Changes the toggle control of 16-bit timer/event counter AB (TAB).
TABn_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter AB (TAB) (high/low level width).
TABn_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter AB (TAB).
TABn_ChangeDuty	Changes the duty ratio of the PWM signal.
TABn_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
TMT0_Init	Performs initialization necessary to control 16-bit timer/event counter T (TMT) functions.
TMT0_UserInit	Performs user-defined initialization relating to the 16-bit timer/event counter T (TMT).
TMT0_Start	Starts the count for 16-bit timer/event counter T (TMT).
TMT0_Stop	Ends the count for 16-bit timer/event counter T (TMT).
TMT0_ChangeTimerCondition	Changes the counter value for 16-bit timer/event counter T (TMT).
TMT0_GetPulseWidth	Reads the pulse width of 16-bit timer/event counter T (TMT) (high/low level width).
TMT0_GetFreeRunningValue	Reads the value captured by 16-bit timer/event counter T (TMT).
TMT0_ChangeDuty	Changes the duty ratio of the PWM signal.
TMT0_SoftwareTriggerOn	Generates the trigger (software trigger) for timer output.
TMT0_EnableHold	Changes the encoder counter control of 16-bit timer/event counter T (TMT) to holding count value.
TMT0_DisableHold	Changes the encoder counter control of 16-bit timer/event counter T (TMT) to normal operation.
TMT0_ChangeCountValue	Changes the initial counter value for 16-bit timer/event counter T (TMT).
TMMn_Init	Performs initialization necessary to control 16-bit interval timer M (TMM) functions.
TMMn_UserInit	Performs user-defined initialization relating to the 16-bit interval timer M (TMM).
TMMn_Start	Starts the count for 16-bit interval timer M (TMM).
TMMn_Stop	Ends the count for 16-bit interval timer M (TMM).
TMMn_ChangeTimerCondition	Changes the counter value for 16-bit interval timer M (TMM).

TMP*n*_Init

Performs initialization necessary to control 16-bit timer/event counter P (TMP) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TMPn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMP*n*_UserInit

Performs user-defined initialization relating to the 16-bit timer/event counter P (TMP).

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

[Classification]

CG_timer_user.c

[Syntax]

```
void    TMPn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMP*n*_Start

Starts the count for 16-bit timer/event counter P (TMP).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMPn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMP*n*_Stop

Ends the count for 16-bit timer/event counter P (TMP).

Remark The length of time between the call to this API function and the end of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMPn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMP*n*_ChangeTimerCondition

Changes the counter value for 16-bit timer/event counter P (TMP).

Remark The value specified in parameter *arrar_reg* is set in TMP*n* capture/compare register *m* (TP*n*CCR*m*).

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TMPn_ChangeTimerCondition ( USHORT *array_reg, UCHAR array_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`USHORT *array_reg;`	Pointer to an area storing the count value (0x0 to 0xffff)
I	`UCHAR array_num;`	Register to change 1: TP*n*CCR0 2: TP*n*CCR0, TP*n*CCR1

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

[Example]

The example below shows changing the interval time to one half.
In this example, channel 0 has been selected for the interval timer.

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    int     flag_finish = 1;
    USHORT  array_reg = TMP_TP0CCR0_VALUE >> 1;            /* TMP_TP0CCR0_VALUE: Current
interval time */
    UCHAR   array_num = 1;
    ......
    TMP0_Start ();                                         /* Start count */
    while ( flag_finish );                                 /* Check for time up */
```

```
    ......
    TMP0_ChanneTimerCondition ( &array_reg, array_num );    /* Change counter value */
   ......
}
```

TMP*n*_GetPulseWidth

Reads the pulse width of 16-bit timer/event counter P (TMP) (high/low level width).

Remarks 1. This API function can only be called when 16-bit timer/event counter P (TMP) is being used for pulse width measurement.

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

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMPn_GetPulseWidth ( ULONG *activewith, ULONG *inactivewidth );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *activewith;`	Pointer to an area storing the high level width that was read (0x0 to 0x1ffff)
O	`ULONG *inactivewidth;`	Pointer to an area storing the low level width that was read (0x0 to 0x1ffff)

[Return value]

None.

TMP*n*_GetFreeRunningValue

Reads the value captured by 16-bit timer/event counter P (TMP).

Remark This API function can only be called when 16-bit timer/event counter P (TMP) is used as a free-running timer, and TMP*n* capture/compare register m (TP*n*CCR*m*) is selected as the capture register.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TMPn_GetFreeRunningValue ( ULONG *count, enum TMChannel channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *count;`	Pointer to area in which to store the width that was read
I	`enum TMChannel channel;`	Channel to read TMCHANNEL0: Channel 0 (TP*n*CCR0) TMCHANNEL1: Channel 1 (TP*n*CCR1)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TMP*n*_ChangeDuty

Changes the duty ratio of the PWM signal.

Remark This API function can only be called when 16-bit timer/event counter P (TMP) is used for external trigger pulse output / PWM output.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMPn_ChangeDuty ( UCHAR array_duty );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *array_duty*;	Duty ratio (0 to 100, unit: %)

Remark The value set to duty ratio *array_duty* must be in base 10 notation.

[Return value]

None.

[Example]

The example below shows changing the duty ratio to 25%.

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    int     flagStatus = 1;
    UCHAR   array_duty = 25;
    ......
    TMP0_Start ();                      /* Start count */
    while ( flagStatus );
    TMP0_ChangeDuty ( array_duty );     /* Change duty ratio */
    ......
}
```

TMP*n*_SoftwareTriggerOn

Generates the trigger (software trigger) for timer output.

Remark This API function can only be called when 16-bit timer/event counter P (TMP) is used for external trigger pulse output / one-shot pulse output.

[Classification]

CG_timer.c

[Syntax]

```
void    TMPn_SoftwareTriggerOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMQ0_Init

Performs initialization necessary to control 16-bit timer/event counter Q (TMQ) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TMQ0_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMQ0_UserInit

Performs user-defined initialization relating to the 16-bit timer/event counter Q (TMQ).

Remark This API function is called as the TMQ0_Init callback routine.

[Classification]

CG_timer_user.c

[Syntax]

```
void    TMQ0_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMQ0_Start

Starts the count for 16-bit timer/event counter Q (TMQ).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMQ0_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMQ0_Stop

Ends the count for 16-bit timer/event counter Q (TMQ).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMQ0_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMQ0_ChangeTimerCondition

Changes the counter value for 16-bit timer/event counter Q (TMQ).

Remark The value specified in parameter *arrar_reg* is set to TMQ0 capture/compare register *m* "TQ0CCR*m*".

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TMQ0_ChangeTimerCondition ( USHORT *array_reg, UCHAR array_num );
```

[Argument(s)]

I/O	Argument	Description
I	USHORT *array_reg;	Pointer to an area storing the count value (0x0 to 0xffff)
I	UCHAR array_num;	Register to change 1: TQ0CCR0 2: TQ0CCR0, TQ0CCR1 3: TQ0CCR0, TQ0CCR1, TQ0CCR2 4: TQ0CCR0, TQ0CCR1, TQ0CCR2, TQ0CCR3

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

[Example]

The example below shows changing the interval time to one half.
In this example, channel 0 has been selected for the interval timer.

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    int     flag_finish = 1;
    USHORT  array_reg = TMQ_TQ0CCR0_VALUE >> 1;            /* TMQ_TQ0CCR0_VALUE: Current
interval time */
    UCHAR   array_num = 1;
    ......
    TMQ0_Start ();                                         /* Start count */
    while ( flag_finish );                                 /* Check for time up */
```

```
    ......
    TMQ0_ChanneTimerCondition ( &array_reg, array_num );    /* Change counter value */
   ......
}
```

TMQ0_GetPulseWidth

Reads the pulse width of 16-bit timer/event counter Q (TMQ) (high/low level width).

Remarks 1. This API function can only be called when 16-bit timer/event counter Q (TMQ) is being used for pulse width measurement.

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

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMQ0_GetPulseWidth ( ULONG *activewith, ULONG *inactivewidth );
```

[Argument(s)]

I/O	Argument	Description
O	`ULONG *activewith;`	Pointer to an area storing the high level width that was read (0x0 to 0x1ffff)
O	`ULONG *inactivewidth;`	Pointer to an area storing the low level width that was read (0x0 to 0x1ffff)

[Return value]

None.

TMQ0_GetFreeRunningValue

Reads the value captured by 16-bit timer/event counter Q (TMQ).

Remark This API function can only be called when 16-bit timer/event counter Q (TMQ) is used as a free-running timer, and TQ0 capture/compare register m (TQ0CCR*m*) is selected as the capture register.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TMQ0_GetFreeRunningValue ( ULONG *count, enum TMChannel channel );
```

[Argument(s)]

I/O	Argument	Description
O	`ULONG *count;`	Pointer to area in which to store the width that was read
I	`enum TMChannel channel;`	Channel to read TMCHANNEL0: Channel 0 (TQ0CCR0) TMCHANNEL1: Channel 1 (TQ0CCR1) TMCHANNEL2: Channel 2 (TQ0CCR2) TMCHANNEL3: Channel 3 (TQ0CCR3)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TMQ0_ChangeDuty

Changes the duty ratio of the PWM signal.

Remark This API function can only be called when 16-bit timer/event counter Q (TMQ) is used for external trigger pulse output / PWM output.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TMQ0_ChangeDuty ( UCHAR *array_duty, UCHAR array_num );
```

[Argument(s)]

I/O	Argument	Description
I	UCHAR *array_duty;	Pointer to an area storing the duty ratio (0 to 100; in percent)
I	UCHAR array_num;	Register to change 1: TQ0CCR1 2: TQ0CCR1, TQ0CCR2 3: TQ0CCR1, TQ0CCR2, TQ0CCR3

Remark The value set to duty ratio *array_duty* must be in base 10 notation.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

[Example]

The example below shows changing the duty ratio to 25%.

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    int     flagStatus = 1;
    UCHAR   array_duty = 25;
    UCHAR   array_num = 1;
    ......
    TMQ0_Start ();                              /* Start count */
    while ( flagStatus );
```

```
    TMQ0_ChangeDuty ( &array_duty, array_num );     /*Change duty ratio */
    ......
}
```

TMQ0_SoftwareTriggerOn

Generates the trigger (software trigger) for timer output.

Remark This API function can only be called when 16-bit timer/event counter Q (TMQ) is used for external trigger pulse output / one-shot pulse output.

[Classification]

CG_timer.c

[Syntax]

```
void    TMQ0_SoftwareTriggerOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

TAA*n*_Init

Performs initialization necessary to control 16-bit timer/event counter AA (TAA) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TAAn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAA*n*_UserInit

Performs user-defined initialization relating to the 16-bit timer/event counter AA (TAA).

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

[Classification]

CG_timer_user.c

[Syntax]

```
void    TAAn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAA*n*_Start

Starts the count for 16-bit timer/event counter AA (TAA).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TAAn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAA*n*_Stop

Ends the count for 16-bit timer/event counter AA (TAA).

Remark The length of time between the call to this API function and the end of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TAAn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAA*n*_ChangeTimerCondition

Changes the counter value for 16-bit timer/event counter AA (TAA).

Remark The value specified in parameter *arrar_reg* is set in TAA*n* capture/compare register *m* (TAA*n*CCR*m*).

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TAAn_ChangeTimerCondition ( USHORT *array_reg, UCHAR array_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`USHORT *array_reg;`	Pointer to an area storing the count value (0x0 to 0xffff)
I	`UCHAR array_num;`	Register to change 1: TAA*n*CCR0 2: TAA*n*CCR0, TAA*n*CCR1

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAA*n*_ControlOutputToggle

Changes the toggle control of 16-bit timer/event counter AA (TAA).

Remark This API function can only be called when 16-bit timer/event counter AA (TAA) is used for interval timer / free-running timer.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TAAn_ControlOutputToggle ( enum TMOut toggle, enum TMChannel channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`enum TMOutput toggle;`	Toggle control STANDARD: Normal toggle operation INACTIVE: Reset request ACTIVE: Set request FREEZE: Keep request
I	`enum TMChannel channel;`	pin to change TMCHANNEL0: TOAA*n*0 pin TMCHANNEL1: TOAA*n*1 pin

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAA*n*_GetPulseWidth

Reads the pulse width of 16-bit timer/event counter AA (TAA) (high/low level width).

Remarks 1. This API function can only be called when 16-bit timer/event counter AA (TAA) is being used for pulse width measurement.

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

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TAAn_GetPulseWidth ( ULONG *activewith, ULONG *inactivewidth );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *activewith;`	Pointer to an area storing the high level width that was read (0x0 to 0x1ffff)
O	`ULONG *inactivewidth;`	Pointer to an area storing the low level width that was read (0x0 to 0x1ffff)

[Return value]

None.

TAA*n*_GetFreeRunningValue

Reads the value captured by 16-bit timer/event counter AA (TAA).

Remark This API function can only be called when 16-bit timer/event counter AA (TAA) is used as a free-running timer, and TAA*n* capture/compare register m (TAA*n*CCR*m*) is selected as the capture register.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TAAn_GetFreeRunningValue ( ULONG *count, enum TMChannel channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *count;`	Pointer to area in which to store the width that was read
I	`enum TMChannel channel;`	Channel to read TMCHANNEL0: Channel 0 (TAA*n*CCR0) TMCHANNEL1: Channel 1 (TAA*n*CCR1)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAA*n*_ChangeDuty

Changes the duty ratio of the PWM signal.

Remark This API function can only be called when 16-bit timer/event counter AA (TAA) is used for external trigger pulse output / PWM output.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TAAn_ChangeDuty ( UCHAR array_duty );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *array_duty*;	Duty ratio (0 to 100, unit: %)

Remark The value set to duty ratio *array_duty* must be in base 10 notation.

[Return value]

None.

TAA*n*_SoftwareTriggerOn

Generates the trigger (software trigger) for timer output.

Remark This API function can only be called when 16-bit timer/event counter AA (TAA) is used for external trigger pulse output / one-shot pulse output.

[Classification]

CG_timer.c

[Syntax]

```
void    TAAn_SoftwareTriggerOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAB*n*_Init

Performs initialization necessary to control 16-bit timer/event counter AB (TAB) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TABn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAB*n*_UserInit

Performs user-defined initialization relating to the 16-bit timer/event counter AB (TAB).

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

[Classification]

CG_timer_user.c

[Syntax]

```
void    TABn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAB*n*_Start

Starts the count for 16-bit timer/event counter AB (TAB).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TABn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAB*n*_Stop

Ends the count for 16-bit timer/event counter AB (TAB).

Remark The length of time between the call to this API function and the end of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TABn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TAB*n*_ChangeTimerCondition

Changes the counter value for 16-bit timer/event counter AB (TAB).

Remark The value specified in parameter *arrar_reg* is set in TAB*n* capture/compare register *m* (TAB*n*CCR*m*).

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TABn_ChangeTimerCondition ( USHORT *array_reg, UCHAR array_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`USHORT *array_reg;`	Pointer to an area storing the count value (0x0 to 0xffff)
I	`UCHAR array_num;`	Register to change 1: TAB*n*CCR0 2: TAB*n*CCR0, TAB*n*CCR1 3: TAB*n*CCR0, TAB*n*CCR1, TAB*n*CCR2 4: TAB*n*CCR0, TAB*n*CCR1, TAB*n*CCR2, TAB*n*CCR3

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAB*n*_ControlOutputToggle

Changes the toggle control of 16-bit timer/event counter AB (TAB).

Remark This API function can only be called when 16-bit timer/event counter AB (TAB) is used for interval timer / free-running timer.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TABn_ControlOutputToggle ( enum TMOut toggle, enum TMChannel channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`enum TMOutput toggle;`	Toggle control STANDARD: Normal toggle operation INACTIVE: Reset request ACTIVE: Set request FREEZE: Keep request
I	`enum TMChannel channel;`	pin to change TMCHANNEL0: TOAB*n*0 pin TMCHANNEL1: TOAB*n*1 pin

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAB*n*_GetPulseWidth

Reads the pulse width of 16-bit timer/event counter AB (TAB) (high/low level width).

Remarks 1. This API function can only be called when 16-bit timer/event counter AB (TAB) is being used for pulse width measurement.

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

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TABn_GetPulseWidth ( ULONG *activewith, ULONG *inactivewidth );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *activewith;`	Pointer to an area storing the high level width that was read (0x0 to 0x1ffff)
O	`ULONG *inactivewidth;`	Pointer to an area storing the low level width that was read (0x0 to 0x1ffff)

[Return value]

None.

TAB*n*_GetFreeRunningValue

Reads the value captured by 16-bit timer/event counter AB (TAB).

Remark This API function can only be called when 16-bit timer/event counter AB (TAB) is used as a free-running timer, and TAB*n* capture/compare register m (TAB*n*CCR*m*) is selected as the capture register.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TABn_GetFreeRunningValue ( ULONG *count, enum TMChannel channel );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`ULONG *count;`	Pointer to area in which to store the width that was read
I	`enum TMChannel channel;`	Channel to read TMCHANNEL0: Channel 0 (TAB*n*CCR0) TMCHANNEL1: Channel 1 (TAB*n*CCR1) TMCHANNEL2: Channel 2 (TAB*n*CCR2) TMCHANNEL3: Channel 3 (TAB*n*CCR3)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAB*n*_ChangeDuty

Changes the duty ratio of the PWM signal.

Remark This API function can only be called when 16-bit timer/event counter AB (TAB) is used for external trigger pulse output / PWM output.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_ATATUS   TABn_ChangeDuty ( UCHAR array_duty, UCHAR array_num );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	UCHAR *array_duty*;	Duty ratio (0 to 100, unit: %)
I	UCHAR *array_num*;	Register to change 1: TAB*n*CCR1 2: TAB*n*CCR1, TP*n*CCR2 3: TAB*n*CCR1, TP*n*CCR2, TP*n*CCR3

Remark The value set to duty ratio *array_duty* must be in base 10 notation.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TAB*n*_SoftwareTriggerOn

Generates the trigger (software trigger) for timer output.

Remark This API function can only be called when 16-bit timer/event counter AB (TAB) is used for external trigger pulse output / one-shot pulse output.

[Classification]

CG_timer.c

[Syntax]

```
void    TABn_SoftwareTriggerOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMT0_Init

Performs initialization necessary to control 16-bit timer/event counter T (TMT) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_UserInit

Performs user-defined initialization relating to the 16-bit timer/event counter T (TMT).

Remark This API function is called as the TMT0_Init callback routine.

[Classification]

CG_timer_user.c

[Syntax]

```
void    TMT0_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_Start

Starts the count for 16-bit timer/event counter T (TMT).

Remark The length of time between the call to this API function and the start of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_Stop

Ends the count for 16-bit timer/event counter T (TMT).

Remark The length of time between the call to this API function and the end of counting will vary depending on the function type (e.g. interval timer, external event counter, or external trigger pulse output).

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_ChangeTimerCondition

Changes the counter value for 16-bit timer/event counter T (TMT).

Remark The value specified in parameter *arrar_reg* is set in TMT0 capture/compare register *m* (TT0CCR*m*).

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TMT0_ChangeTimerCondition ( USHORT *array_reg, UCHAR array_num );
```

[Argument(s)]

I/O	Argument	Description
I	`USHORT *array_reg;`	Pointer to an area storing the count value (0x0 to 0xffff)
I	`UCHAR array_num;`	Register to change 1: TT0CCR0 2: TT0CCR0, TT0CCR1

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TMT0_GetPulseWidth

Reads the pulse width of 16-bit timer/event counter T (TMT) (high/low level width).

Remarks 1. This API function can only be called when 16-bit timer/event counter T (TMT) is being used for pulse width measurement.

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

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMT0_GetPulseWidth ( ULONG *activewith, ULONG *inactivewidth );
```

[Argument(s)]

I/O	Argument	Description
O	`ULONG *activewith;`	Pointer to an area storing the high level width that was read (0x0 to 0x1ffff)
O	`ULONG *inactivewidth;`	Pointer to an area storing the low level width that was read (0x0 to 0x1ffff)

[Return value]

None.

TMT0_GetFreeRunningValue

Reads the value captured by 16-bit timer/event counter T (TMT).

Remark This API function can only be called when 16-bit timer/event counter T (TMT) is used as a free-running timer, and TMT0 capture/compare register m (TT0CCR*m*) is selected as the capture register.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_timer.h"
MD_STATUS   TMT0_GetFreeRunningValue ( ULONG *count, enum TMChannel channel );
```

[Argument(s)]

I/O	Argument	Description
O	`ULONG *count;`	Pointer to area in which to store the width that was read
I	`enum TMChannel channel;`	Channel to read TMCHANNEL0: Channel 0 (TP*n*CCR0) TMCHANNEL1: Channel 1 (TP*n*CCR1)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TMT0_ChangeDuty

Changes the duty ratio of the PWM signal.

Remark This API function can only be called when 16-bit timer/event counter T (TMT) is used for external trigger pulse output / PWM output.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   TMT0_ChangeDuty ( UCHAR array_duty );
```

[Argument(s)]

I/O	Argument	Description
I	UCHAR *array_duty*;	Duty ratio (0 to 100, unit: %)

Remark The value set to duty ratio *array_duty* must be in base 10 notation.

[[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

TMT0_SoftwareTriggerOn

Generates the trigger (software trigger) for timer output.

Remark This API function can only be called when 16-bit timer/event counter T (TMT) is used for external trigger pulse output / one-shot pulse output.

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_SoftwareTriggerOn ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_EnableHold

Changes the encoder counter control of 16-bit timer/event counter T (TMT) to holding count value.

Remark This API function can only be called when 16-bit timer/event counter T (TMT) is used for encoder count.

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_EnableHold ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_DisableHold

Changes the encoder counter control of 16-bit timer/event counter T (TMT) to normal operation.

Remark This API function can only be called when 16-bit timer/event counter T (TMT) is used for encoder count.

[Classification]

CG_timer.c

[Syntax]

```
void    TMT0_DisableHold ( void );
```

[Argument(s)]

None.

[Return value]

None.

TMT0_ChangeCountValue

Changes the initial counter value for 16-bit timer/event counter T (TMT).

Remarks 1. The value specified in parameter *regvalue* is set in TMT0 counter write register (TT0TCW).

2. This API function can only be called when 16-bit timer/event counter T (TMT) is used for encoder count.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMT0_ChangeCountValue ( USHORT regvalue );
```

[Argument(s)]

I/O	Argument	Description
I	`USHORT regvalue;`	Count value (0x0 to 0xffff)

[Return value]

None.

TMM*n*_Init

Performs initialization necessary to control 16-bit interval timer M (TMM) functions.

[Classification]

CG_timer.c

[Syntax]

```
void    TMMn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMM*n*_UserInit

Performs user-defined initialization relating to the 16-bit interval timer M (TMM).

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

[Classification]

CG_timer_user.c

[Syntax]

```
void    TMMn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMM*n*_Start

Starts the count for 16-bit interval timer M (TMM).

[Classification]

CG_timer.c

[Syntax]

```
void    TMMn_Start ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMM*n*_Stop

Ends the count for 16-bit interval timer M (TMM).

[Classification]

CG_timer.c

[Syntax]

```
void    TMMn_Stop ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

TMM*n*_ChangeTimerCondition

Changes the counter value for 16-bit interval timer M (TMM).

Remark The value specified in parameter *regvalue* is set to TMM*n* control register 0”TM*n*CMP0”.

[Classification]

CG_timer.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    TMMn_ChangeTimerCondition ( USHORT regvalue );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`USHORT regvalue;`	Counter value (0x0 to 0xffff)

[Return value]

None.

C.3.9 Watch Timer

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

Table C-10. API Functions: [Watch Timer]

API Function Name	Function
WT_Init	Performs initialization necessary to control watch timer functions.
WT_UserInit	Performs user-defined initialization relating to the watch timer.
WT_Start	Clears the watch timer counter and resumes counting.
WT_Stop	Ends the count for watch timer.

WT_Init

Performs initialization necessary to control watch timer functions.

[Classification]

CG_wt.c

[Syntax]

```
void    WT_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

WT_UserInit

Performs user-defined initialization relating to the watch timer.

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

[Classification]

CG_wt_user.c

[Syntax]

```
void    WT_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

WT_Start

Clears the watch timer counter and resumes counting.

[Classification]

CG_wt.c

[Syntax]

```
void    WT_Start ( void );
```

[Argument(s)]

None.

[Return value]

None.

WT_Stop

Ends the count for watch timer.

[Classification]

CG_wt.c

[Syntax]

```
void    WT_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

[Example]

The example below illustrates use of the watch timer function.

[CG_main.c]

```
#include    "CG_macrodriver.h"
ULONG   INT_flg = 0;
void main ( void ) {
    WT_Start ();            /* Start count */
    while ( !INT_flg );
    WT_Stop ();             /* End count */
    ......
}
```

[CG_wt_user.c]

```
#include    "CG_macrodriver.h"
extern  ULONG   INT_flg;
__interrupt void MD_INTWT ( void ) {    /* Interrupt processing for INTWT */
    INT_flg = 1;
}
```

C.3.10 RTC

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

Table C-11. API Functions: [RTC]

API Function Name	Function
RTC_Init	Performs initialization necessary to control real-time counter functions.
RTC_UserInit	Performs user-defined initialization relating to the real-time counter.
RTC_CounterEnable	Starts the count of the real-time counter (year, month, weekday, day, hour, minute, second).
RTC_CounterDisable	Ends the count of the real-time counter (year, month, weekday, day, hour, minute, second).
RTC_SetHourSystem	Sets the clock type (12-hour or 24-hour clock) of the real-time counter.
RTC_CounterSet	Sets the counter value (year, month, weekday, day, hour, minute, second) of the real-time counter.
RTC_CounterGet	Reads the counter value (year, month, weekday, day, hour, minute, second) of the real-time counter.
RTC_ConstPeriodInterruptEnable	Sets the cycle of the interrupts INTRTC0, then starts the cyclic interrupt function.
RTC_ConstPeriodInterruptDisable	Ends the cyclic interrupt function.
RTC_AlarmEnable	Starts the alarm interrupt function.
RTC_AlarmDisable	Ends the alarm interrupt function.
RTC_AlarmSet	Sets the alarm conditions (weekday, hour, minute).
RTC_AlarmGet	Reads the alarm conditions (weekday, hour, minute).
RTC_IntervalStart	Starts the interval interrupt function.
RTC_IntervalStop	Ends the interval interrupt function.
RTC_IntervalInterruptEnable	Sets the cycle of the interrupts INTRTC2, then starts the interval interrupt function.
RTC_IntervalInterruptDisable	Ends the interval interrupt function.
RTC_RC1CK1HZ_OutputEnable	Enables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.
RTC_RC1CK1HZ_OutputDisable	Disables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.
RTC_RC1CKO_OutputEnable	Enables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.
RTC_RC1CKO_OutputDisable	Disables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.
RTC_RC1CKDIV_OutputEnable	Enables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.
RTC_RC1CKDIV_OutputDisable	Disables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.
RTC_RTC1HZ_OutputEnable	Enables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.
RTC_RTC1HZ_OutputDisable	Disables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.
RTC_RTCCL_OutputEnable	Enables output of the real-time counter clock (32 kHz source) to the RTCCL pin.
RTC_RTCCL_OutputDisable	Disables output of the real-time counter clock (32 kHz source) to the RTCCL pin.
RTC_RTCDIV_OutputEnable	Enables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.
RTC_RTCDIV_OutputDisable	Disables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.
RTC_ChangeCorrectionValue	Changes the timing and correction value for correcting clock errors.

RTC_Init

Performs initialization necessary to control real-time counter functions.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_UserInit

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

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

[Classification]

CG_rtc_user.c

[Syntax]

```
void    RTC_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_CounterEnable

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

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_CounterEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_CounterDisable

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

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_CounterDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_SetHourSystem

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

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_SetHourSystem ( enum RTCHourSystem hoursystem );
```

[Argument(s)]

I/O	Argument	Description
I	`enum RTCHourSystem hoursystem;`	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 "CG_rtc.h" larger.

[Example]

Below is an example of setting the clock type to the 24-hour clock.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    ......
    RTC_CounterEnable ();           /* Start count */
    ......
    RTC_SetHourSystem ( HOUR24 );   /* Set clock type */
```

```
    ......
}
```

RTC_CounterSet

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

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_CounterSet ( struct RTCCounterValue counterwriteval );
```

[Argument(s)]

I/O	Argument	Description
I	`struct RTCCounterValue counterwriteval;`	Counter value

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

```
struct  RTCCounterValue {
    UCHAR   Sec;    /* second */
    UCHAR   Min;    /* Minute */
    UCHAR   Hour;   /* Hour */
    UCHAR   Day;    /* Day */
    UCHAR   Week;   /* Weekday (0: Sunday, 6: Saturday) */
    UCHAR   Month;  /* Month */
    UCHAR   Year;   /* Year */
};
```

[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 "CG_rtc.h" larger.

[Example]

The example below shows the counter value of the real-time counter being set to "2008/12/25 (Thu.) 17:30:00".

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( main ) {
    struct  RTCCounterValue counterwriteval;
    ......
    RTC_CounterEnable ();               /* Start count */
    ......
    counterwriteval.Year = 0x08;
    counterwriteval.Month = 0x12;
    counterwriteval.Day = 0x25;
    counterwriteval.Week = 0x05;
    counterwriteval.Hour = 0x17;
    counterwriteval.Min = 0x30;
    counterwriteval.Sec = 0;
    RTC_SetHourSystem ( HOUR24 );       /* Set clock type */
    RTC_CounterSet ( counterwriteval ); /* Set counter value */
    ......
}
```

RTC_CounterGet

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

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_CounterGet ( struct RTCCounterValue *counterreadval );
```

[Argument(s)]

I/O	Argument	Description
O	`struct RTCCounterValue *counterreadval;`	Pointer to structure in which to store the counter value being read

Remark See RTC_CounterSet for details about the RTCCounterValue 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 "CG_rtc.h" larger.

[Example]

Below is an example of reading the counter value of the real-time counter.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    struct  RTCCounterValue counterreadval;
    ......
    RTC_CounterEnable ();               /* Start count */
    ......
    RTC_CounterGet ( &counterreadval ); /* Read count value */
```

```
    ......
}
```

RTC_ConstPeriodInterruptEnable

Sets the cycle of the interrupts INTRTC0, then starts the cyclic interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_ConstPeriodInterruptEnable ( enum RTCINTPeriod period );
```

[Argument(s)]

I/O	Argument	Description
I	`enum RTCINTPeriod period;`	Interrupt INTRTC0 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

[Example]

Below is an example of setting the cycle of the interrupts INTRTC0, then starting the cyclic interrupt function.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    ......
    RTC_ConstPeriodInterruptDisable ();         /* End of cyclic interrupt function */
    ......
    RTC_ConstPeriodInterruptEnable ( HALFSEC ); /* Start of cyclic interrupt function */
    ......
}
```

RTC_ConstPeriodInterruptDisable

Ends the cyclic interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_ConstPeriodInterruptDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_AlarmEnable

Starts the alarm interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_AlarmEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_AlarmDisable

Ends the alarm interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_AlarmDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_AlarmSet

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

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void    RTC_AlarmSet ( struct RTCAlarmValue alarmval );
```

[Argument(s)]

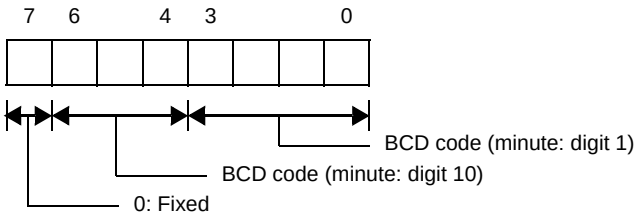
I/O	Argument	Description
I	`struct RTCAlarmValue alarmval;`	Alarm conditions (weekday, hour, minute)

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

```
struct  RTCAlarmValue {
    UCHAR   Alarmwm;    /* Minute */
    UCHAR   Alarmwh;    /* Hour */
    UCHAR   Alarmww;    /* Weekday */
};
```

- Alarmwm (Minute)

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

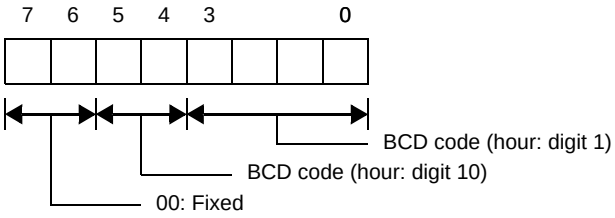


- Alarmwh (Hour)

  Below are shown the meanings of each bit of the structure member Alarmwh. If the real-time counter is set to the 12-hour clock, then bit 5 has the following meaning.

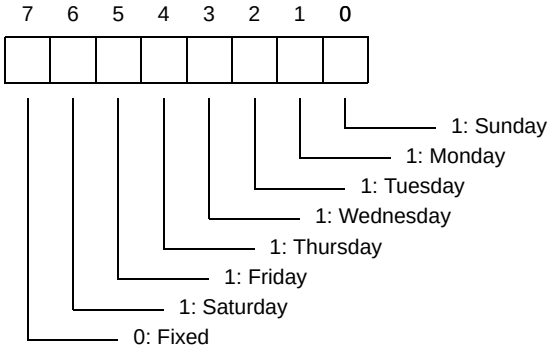
  0: AM

  1: PM



- Alarmww (Weekday)

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



[Return value]

None.

[Example 1]

The example below shows the alarm conditions being set to "Monday/Tuesday/Wednesday at 17:30".

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    struct  RTCAlarmValue   alarmval;
    ......
    RTC_AlarmEnable ();             /* Start alarm interrupt function */
    RTC_CounterEnable ();           /* Start count */
    ......
    RTC_SetHourSystem ( HOUR24 );   /* Set clock type */
    alarmval.Alarmww = 0xe;
    alarmval.Alarmwh = 0x17;
    alarmval.Alarmwm = 0x30;
    RTC_AlarmSet ( alarmval );      /* Set conditions */
    ......
}
```

[Example 2]

The example below shows the alarm conditions being set to "Saturday/Sunday (time left unchanged)".

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    struct  RTCAlarmValue   alarmval;
    ......
    RTC_AlarmEnable ();             /* Start alarm interrupt function */
    ......
    alarmval.Alarmww = 0x41;
    RTC_AlarmSet ( alarmval );      /* Change conditions */
    ......
}
```

RTC_AlarmGet

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

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void    RTC_AlarmGet ( struct RTCAlarmValue *alarmval );
```

Remark See RTC_AlarmSet for details about RTCAlarmValue (alarm conditions).

[Argument(s)]

I/O	Argument	Description
O	`struct RTCAlarmValue *alarmval;`	Pointer to structure in which to store the conditions being read

[Return value]

None.

[Example]

The example below shows the alarm conditions being read.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    struct  RTCAlarmValue   alarmval;
    ......
    RTC_AlarmEnable ();         /* Start alarm interrupt function */
    ......
    RTC_AlarmGet ( &alarmval ); /* Read conditions */
    ......
}
```

RTC_IntervalStart

Starts the interval interrupt function.

Remark After setting the cycle of the interrupts INTRTC2, call RTC_IntervalInterruptEnable to start the interval interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_IntervalStart ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_IntervalStop

Ends the interval interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_IntervalStop ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_IntervalInterruptEnable

Sets the cycle of the interrupts INTRTC2, then starts the interval interrupt function.

Remark Call RTC_IntervalStart to start the interval interrupt function without setting the cycle of the interrupts INTRTC2.

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_IntervalInterruptEnable ( enum RTCINTInterval interval );
```

[Argument(s)]

I/O	Argument	Description
I	`enum RTCINTInterval interval;`	Interrupt INTRTC2 cycle INTERVAL0: 2^6/fRTC INTERVAL1: 2^7/fRTC INTERVAL2: 2^8/fRTC INTERVAL3: 2^9/fRTC INTERVAL4: 2^10/fRTC INTERVAL5: 2^11/fRTC INTERVAL6: 2^12/fRTC

Remark fRTC is the frequency of the subsystem clock.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

[Example]

Below is an example of changing the interval, the restarting the interval interrupt function.

[CG_main.c]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
void main ( void ) {
    ......
```

```
    RTC_IntervalStart ();                       /* Start interval interrupt function */
    ......
    RTC_IntervalStop ();                        /* End interval interrupt function */
    ......
    RTC_IntervalInterruptEnable ( INTERVAL6 );  /* Start interval interrupt function */
    ......
}
```

RTC_IntervalInterruptDisable

Ends the interval interrupt function.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_IntervalInterruptDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CK1HZ_OutputEnable

Enables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CK1HZ_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CK1HZ_OutputDisable

Disables output of the real-time counter correction clock (1 Hz) to the RC1CK1HZ pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CK1HZ_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CKO_OutputEnable

Enables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CKO_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CKO_OutputDisable

Disables output of the real-time counter clock (32 kHz source) to the RC1CKO pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CKO_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CKDIV_OutputEnable

Enables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CKDIV_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RC1CKDIV_OutputDisable

Disables output of the real-time counter clock (32 kHz cycle) to the RC1CKDIV pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RC1CKDIV_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTC1HZ_OutputEnable

Enables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTC1HZ_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTC1HZ_OutputDisable

Disables output of the real-time counter correction clock (1 Hz) to the RTC1HZ pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTC1HZ_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTCCL_OutputEnable

Enables output of the real-time counter clock (32 kHz source) to the RTCCL pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTCCL_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTCCL_OutputDisable

Disables output of the real-time counter clock (32 kHz source) to the RTCCL pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTCCL_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTCDIV_OutputEnable

Enables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTCCLDIV_OutputEnable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_RTCDIV_OutputDisable

Disables output of the real-time counter clock (32 kHz cycle) to the RTCDIV pin.

[Classification]

CG_rtc.c

[Syntax]

```
void    RTC_RTCDIV_OutputDisable ( void );
```

[Argument(s)]

None.

[Return value]

None.

RTC_ChangeCorrectionValue

Changes the timing and correction value for correcting clock errors.

[Classification]

CG_rtc.c

[Syntax]

```
#include    "CG_macrodriver.h"
#include    "CG_rtc.h"
MD_STATUS   RTC_ChangeCorrectionValue ( enum RTCCorectionTiming timing, UCHAR corectval );
```

[Argument(s)]

I/O	Argument	Description
I	`enum RTCCorectionTiming timing;`	When clock errors are corrected EVERY20S: When the seconds digits are 00, 20 or 40 EVERY60S: When the seconds digits are 00
I	`UCHAR corectval;`	Clock error correction value

Remark This API function does not correct clock errors if correction value *corectVal* is set to 0x0, 0x1, 0x40 or 0x41.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

C.3.11 Real-Time Output

Below is a list of API functions output by Code Generator as the real-time output function.

Table C-12. API Functions: [Real-Time Output]

API Function Name	Function
RTOn_Init	Performs initialization necessary to control real-time output functions.
RTOn_UserInit	Performs user-defined initialization relating to the real-time output.
RTOn_Enable	Enables (validates) real-time output.
RTOn_Disable	Disables (invalidates) real-time output.
RTOn_Set2BitData	Sets 2-bit data for real-time output.
RTOn_Set4BitData	Sets 4-bit data for real-time output.
RTOn_Set6BitData	Sets 6-bit data for real-time output.
RTOn_Set8BitData	Sets 8-bit data for real-time output.
RTOn_SetHigh2BitData	Sets higher 2-bit data for real-time output.
RTOn_SetLow2BitData	Sets lower 2-bit data for real-time output.
RTOn_SetHigh4BitData	Sets higher 4-bit data for real-time output.
RTOn_SetLow4BitData	Sets lower 4-bit data for real-time output.
RTOn_GetValue	Reads data from real-time output.

RTO*n*_Init

Performs initialization necessary to control real-time output functions.

[Classification]

CG_rto.c

[Syntax]

```
void    RTOn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

RTO*n*_UserInit

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

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

[Classification]

CG_rto_user.c

[Syntax]

```
void    RTOn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

RTO*n*_Enable

Enables (validates) real-time output.

[Classification]

CG_rto.c

[Syntax]

```
void    RTOn_Enable ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

RTO*n*_Disable

Disables (invalidates) real-time output.

[Classification]

CG_rto.c

[Syntax]

```
void    RTOn_CounterDisable ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

RTO*n*_Set2BitData

Sets 2-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

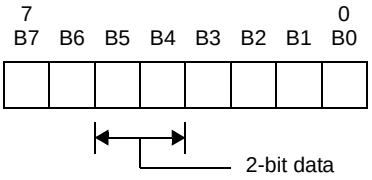
```
#include    "CG_macrodriver.h"
void    RTOn_Set2BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	2-bit data

Remark The API functions treat values set in bits 4 to 5 as 2-bit data.



[Return value]

None.

RTO*n*_Set4BitData

Sets 4-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

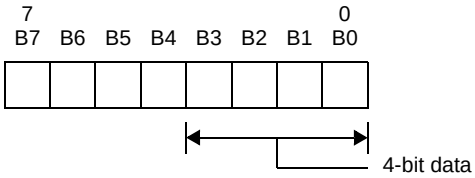
```
#include    "CG_macrodriver.h"
void    RTOn_Set4BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	4-bit data

Remark The API functions treat values set in bits 0 to 3 as 4-bit data.



[Return value]

None.

RTO*n*_Set6BitData

Sets 6-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

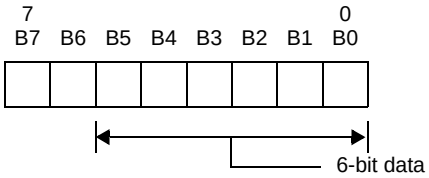
```
#include    "CG_macrodriver.h"
void    RTOn_Set6BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	6-bit data

Remark The API functions treat values set in bits 0 to 5 as 6-bit data.



[Return value]

None.

RTO*n*_Set8BitData

Sets 8-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

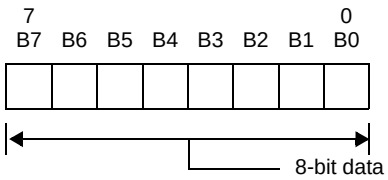
```
#include    "CG_macrodriver.h"
void    RTOn_Set8BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	8-bit data

Remark The API functions treat values set in bits 0 to 7 as 8-bit data.



[Return value]

None.

RTO*n*_SetHigh2BitData

Sets higher 2-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

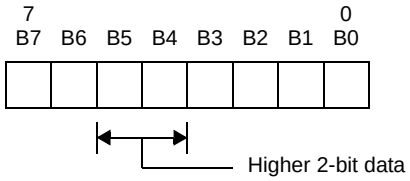
```
#include    "CG_macrodriver.h"
void    RTOn_SetHigh2BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	Higher 2-bit data

Remark The API functions treat values set in bits 4 to 5 as higher 2-bit data.



[Return value]

None.

RTO*n*_SetLow2BitData

Sets lower 2-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

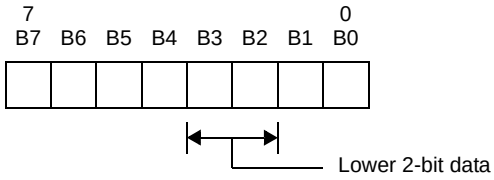
```
#include    "CG_macrodriver.h"
void    RTOn_SetLow2BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	Lower 2-bit data

Remark The API functions treat values set in bits 2 to 3 as lower 2-bit data.



[Return value]

None.

RTO*n*_SetHigh4BitData

Sets higher 4-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

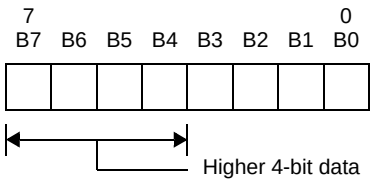
```
#include    "CG_macrodriver.h"
void    RTOn_SetHigh4BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	Higher 4-bit data

Remark The API functions treat values set in bits 4 to 7 as higher 4-bit data.



[Return value]

None.

RTO*n*_SetLow4BitData

Sets lower 4-bit data for real-time output.

[Classification]

CG_rto.c

[Syntax]

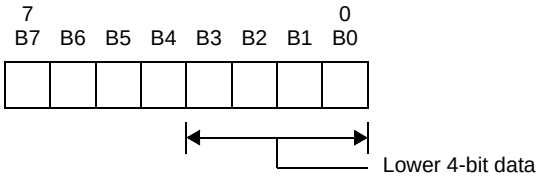
```
#include    "CG_macrodriver.h"
void    RTOn_SetLow4BitsData ( UCHAR data );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UCHAR data;`	Lower 4-bit data

Remark The API functions treat values set in bits 0 to 3 as lower 4-bit data.



[Return value]

None.

RTO*n*_GetValue

Reads data from real-time output.

[Classification]

CG_rto.c

[Syntax]

```
#include    "CG_macrodriver.h"
void    RTOn_GetValue ( UCHAR *value );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
O	`UCHAR *value;`	Pointer to area in which to store the value that was read

[Return value]

None.

[Example]

Below is an example of reading the counter value of the real-time counter.

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    RTO0_Set2BitData ( 0x30 );          /* Set output data */
    RTO0_Enable ();                     /* Enable real-time output */
    ......
    RTO0_Disable ();                    /* Disable real-time output */
    ......
}
```

[CG_timer_user.c]

```
#include    "CG_macrodriver.h"
__interrupt void MD_INTTP4CC0 ( void ) {  /* Interrupt processing for INTTP4CC0 interrupt */
    UCHAR   value = 0;
    RTO0_GetValue ( &value );             /* Read output data */
    value = ~value;
    RTO0_Set2BitData ( value );           /* Set output data */
}
```

C.3.12 DMA

Below is a list of API functions output by Code Generator for DMA (Direct Memory Access) controller use.

Table C-13. API Functions: [DMA]

API Function Name	Function
DMAn_Init	Performs initialization necessary to control DMA controller functions.
DMAn_UserInit	Performs user-defined initialization relating to the DMA controller.
DMAn_Enable	Enables operation of channel *n*.
DMAn_Disable	Disables operation of channel *n*.
DMAn_CheckStatus	Reads the transfer status (transfer complete/transfer ongoing).
DMAn_SetData	Sets the RAM address of the transfer source/destination, and the number of times the data has been transferred.
DMAn_SoftwareTriggerOn	Uses a software trigger as a DMA transfer start trigger.

DMA*n*_Init

Performs initialization necessary to control DMA controller functions.

[Classification]

CG_dma.c

[Syntax]

```
void    DMAn_Init ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DMA*n*_UserInit

Performs user-defined initialization relating to the DMA controller.

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

[Classification]

CG_dma_user.c

[Syntax]

```
void    DMAn_UserInit ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DMA*n*_Enable

Enables operation of channel *n*.

[Classification]

CG_dma.c

[Syntax]

```
void    DMAn_Enable ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

DMA*n*_Disable

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 via DMAn_CheckStatus.

[Classification]

CG_dma.c

[Syntax]

```
void    DMAn_Disable ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

[Example]

The example below shows setting the operation mode of channel 0 to "disabled".

[CG_main.c]

```
#include    "CG_macrodriver.h"
void main ( void ) {
    ......
    while ( MD_COMPLETED == DMA0_CheckStatus () ); /* Check transfer status */
    DMA0_Disable ();                               /* Change to operation disabled status */
    ......
}
```

DMA*n*_CheckStatus

Reads the transfer status (transfer complete/transfer ongoing).

[Classification]

CG_dma.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   DMAn_CheckStatus ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

Macro	Description
MD_UNDEREXEC	Transfer ongoing
MD_COMPLETED	Transfer complete

DMA*n*_SetData

Sets the RAM address of the transfer source/destination, and the number of times the data has been transferred.

Remark Calling this API function while a transfer is ongoing will end the transfer.

[Classification]

CG_dma.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   DMAn_SetData ( UINT srcaddr, UINT dstaddr, UINT count );
```

Remark *n* is the channel number.

[Argument(s)]

I/O	Argument	Description
I	`UINT srcaddr;`	RAM address of source
I	`UINT dstaddr;`	RAM address of destination
I	`UINT count;`	Number of data transmissions (1 to 1024)

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Invalid argument specification

DMA*n*_SoftwareTriggerOn

Uses a software trigger as a DMA transfer start trigger.

Remark After this API function is called, DMA transfer will begin if the start DMA transfer software trigger flag STG*n* is set to "1," or the interrupt (e.g. INTP*n* or INTAD) occurs.

[Classification]

CG_dma.c

[Syntax]

```
void    DMAn_SoftwareTriggerOn ( void );
```

Remark *n* is the channel number.

[Argument(s)]

None.

[Return value]

None.

[Example]

Below is an example of software trigger as a DMA transfer start trigger.

[CG_main.c]

```
void main ( void ) {
    ......
    DMA0_Enable ();             /* Change to operation enabled status */
    DMA0_SoftwareTriggerOn ();  /* Start DMA transfer */
    ......
}
```

C.3.13 LVI

Below is a list of API functions output by Code Generator for low-voltage detector use.

Table C-14. API Functions: [LVI]

API Function Name	Function
LVI_Init	Performs initialization necessary to control low-voltage detector functions.
LVI_UserInit	Performs user-defined initialization relating to the low-voltage detector.
LVI_InterruptModeStart	Starts low-voltage detection (when in interrupt generation mode).
LVI_ResetModeStart	Starts low-voltage detection (when in internal reset mode).
LVI_Start	Starts low-voltage detection.
LVI_Stop	Stops low-voltage detection.

LVI_Init

Performs initialization necessary to control low-voltage detector functions.

[Classification]

CG_lvi.c

[Syntax]

```
void    LVI_Init ( void );
```

[Argument(s)]

None.

[Return value]

None.

LVI_UserInit

Performs user-defined initialization relating to the low-voltage detector.

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

[Classification]

CG_lvi_user.c

[Syntax]

```
void    LVI_UserInit ( void );
```

[Argument(s)]

None.

[Return value]

None.

LVI_InterruptModeStart

Starts low-voltage detection (when in interrupt generation mode).

[Classification]

CG_lvi.c

[Syntax]

```
void    LVI_InterruptModeStart ( void );
```

[Argument(s)]

None.

[Return value]

None.

[Example]

The example below shows the detection of low voltage when the operation mode is interrupt generation mode (generate the interrupt INTLVI).

[CG_main.c]

```
void main ( void ) {
    ......
    LVI_InterruptModeStart ( );         /* Start low-voltage detection */
    ......
}
```

[CG_lvi_user.c]

```
__interrupt void MD_INTLVI ( void ) {   /* Interrupt processing for INTLVI */
    if ( LVIF == 1 ) {                  /* Trigger identification: Check LVIF flag */
        ...... /* Handle case when "power voltage (VDD) < detected voltage (VLVI)" detected */
    } else {
        ...... /* Handle case when "power voltage (VDD) >= detected voltage (VLVI)" detected */
    }
}
```

LVI_ResetModeStart

Starts low-voltage detection (when in internal reset mode).

[Classification]

CG_lvi.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   LVI_ResetModeStart ( void );
```

[Argument(s)]

None.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ERROR	Exit with error (abend) - The program is configured to not use the low-voltage detector function. - The object of low voltage detection is external voltage (V_{DD}), and power voltage (V_{DD}) <= detected voltage (V_{LVI}). - The object of low voltage detection is external input voltage (EXLVI), and external input voltage (EXLVI) <= detected voltage (V_{EXLVI}).

LVI_Start

Starts low-voltage detection.

[Classification]

CG_lvi.c

[Syntax]

```
#include    "CG_macrodriver.h"
MD_STATUS   LVI_Start ( void );
```

[Argument(s)]

None.

[Return value]

Macro	Description
MD_OK	Normal completion
MD_ARGERROR	Exit with error (abend) - The program is configured to not use the low-voltage detector function. - The object of low voltage detection is external voltage (V_{DD}), and power voltage (V_{DD}) <= detected voltage (V_{LVI}). - The object of low voltage detection is external input voltage (EXLVI), and external input voltage (EXLVI) <= detected voltage (V_{EXLVI}).

LVI_Stop

Stops low-voltage detection.

[Classification]

CG_lvi.c

[Syntax]

```
void    LVI_Stop ( void );
```

[Argument(s)]

None.

[Return value]

None.

APPENDIX D INDEX

S

T

U

W

Revision Record

Rev.	Date	Description	
		Page	Summary
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