User's Manual

RX220 Group

Peripheral Driver Generator Reference Manual

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Introduction

This manual was written to explain how to make the peripheral I/O drivers on the Peripheral Driver Generator for RX220. For the basic information about the Peripheral Driver Generator, refer to the Peripheral Driver Generator user’s manual.

Table of Contents

1. Overview

1.1 Supported peripheral modules

The Peripheral Driver Generator supports the following products of RX220 group, peripheral modules and endian.

(1) Products

Part No.	Package
R5F52206BxFP	PLQP0100KB
R5F52206BxFM	PLQP0064KB
R5F52206BxFL	PLQP0048KB
R5F52205BxFP	PLQP0100KB
R5F52205BxFM	PLQP0064KB
R5F52205BxFL	PLQP0048KB

Part No.	Package
R5F52203BxFP	PLQP0100KB
R5F52203BxFM	PLQP0064KB
R5F52203BxFL	PLQP0048KB
R5F52201BxFM	PLQP0064KB
R5F52201BxFL	PLQP0048KB

(2) Peripheral Modules

Voltage Detection Circuit (LVDAa)	Port Output Enable 2 (POE2a)
Clock Generation Circuit	8-Bit Timer (TMR)
Clock Frequency Accuracy Measurement Circuit (CAC)	Compare Match Timer (CMT)
Low Power Consumption	Realtime Clock (RTCc)
Register Write Protection Function	Independent Watchdog Timer (IWDTa)
Interrupt Controller (ICUb), Exceptions	Serial Communications Interface (SCIe,SCIf)
Buses	I^2C Bus Interface (RIIC)
DMA Controller (DMACA)	Serial Peripheral Interface (RSPI)
Data Transfer Controller (DTCa)	CRC Calculator (CRC)
Event Link Controller (ELC)	12-Bit A/D Converter (S12ADb)
I/O Ports	Comparator A (CMPA)
Multifunction Pin Controller (MPC)	Data Operation Circuit (DOC)
Multi-Function Timer Pulse Unit 2 (MTU2a)	

The IrDA Interface is not supported.
The binary-count mode of Realtime Clock (RTCc) is not supported.

(3) Endian

Little
Big

1.2 Tool requirements

The following tools are required for this version of RX220 group Peripheral Driver Generator.

- RX Family C/C++ Compiler Package V.1.02 Release 01
- RX220 Group Renesas Peripheral Driver Library V.1.10 (Bundled in Peripheral Driver Generator)

2. Creating a new project

To create the new project file, select the menu [File] -> [New Project]. New project dialog box will open.

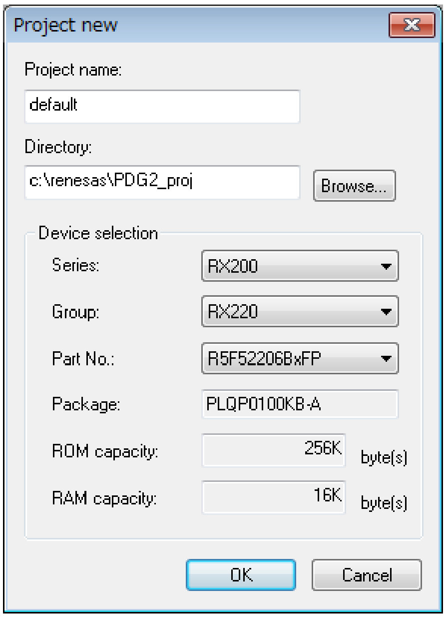


Fig 2.1 New project dialog box

For RX220 group, select [RX200] as a series and select [RX220] as a group. The package type, ROM capacity and RAM capacity of selected product are displayed.

By clicking [OK], new project is created and opened.

The EXTAL input clock frequency is not set after opening a new project. Therefore an error icon is displayed. For error display, refer to the user's manual.

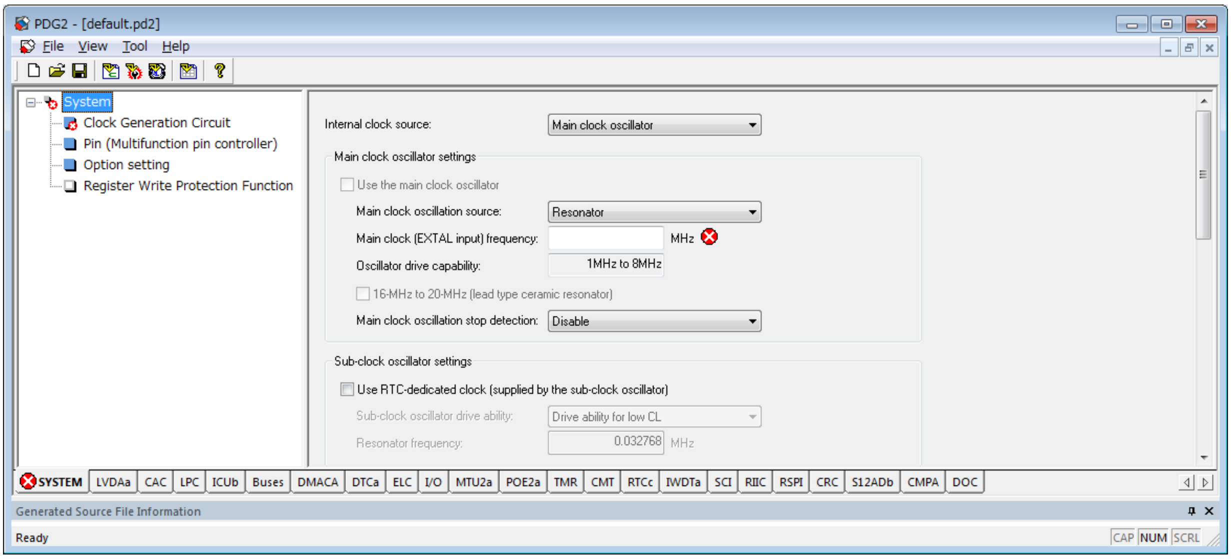


Fig 2.2 Error display of new project

Set the frequency of the clock to be used here.

3. Setting Up the Peripheral Modules

3.1 Main Window

Figure 3.1 shows the main window for setting up peripheral modules.

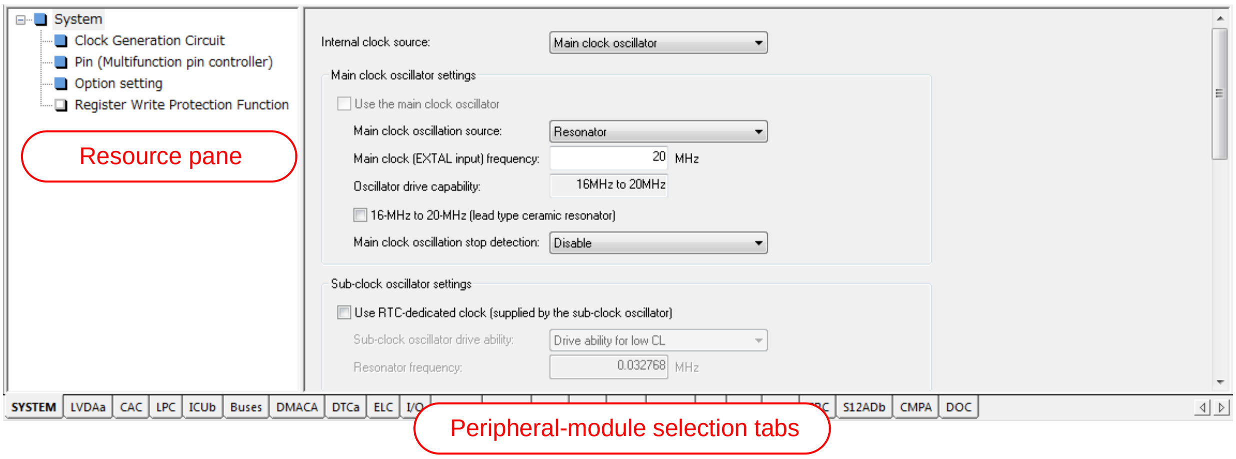


Figure 3.1 Display in the Main Window (Example)

Table 3.1 shows the correspondence between the peripheral-module selection tabs, items in the resource pane, and peripheral modules to be set up.

Table 3.1 Peripheral-Module Selection Tabs, Items in the Resource Pane, and Peripheral Modules

Tab	Resource pane	Corresponding Peripheral Module or Function
SYSTEM	Clock Generation Circuit	Clock Generation Circuit
	Pin(Multifunction pin controller)	Pinfunctions (Multifunction Pin Controller (MPC))
	Option setting	Endian setting
	Register Write Protection Function	Register Write Protection Function
LVDAa	Voltage monitoring 0 to 2	Voltage monitoring 0 to 2
CAC	Clock frequency accuracy measurement circuit (CAC)	Clock Frequency Accuracy Measurement Circuit (CAC)
LPC	Low Power Consumption	Low Power Consumption
ICUb	Interrupts	Interrupt Control Unit (ICUb) (Fastinterrupt, Software Interrupt, External Interrupt (NMI, IRQ0 to IRQ7))
	Exceptions	Exceptions
Buses	Common settings	Bus Priority and Bus Error Monitoring
DMACA	DMACA0 to DMACA3	DMA Controller (DMACA) Channel 0 to 3
DTCa	Data transfer controller (DTCa)	Data Transfer Controller (DTCa)
ELC	Event link settings	Event Link Controller (ELC) event link settings
	Port group and single port settings	Event Link Controller (ELC) port group and single port settings
I/O	Port 0 to Port J	I/O Port 0 to J
MTU2a	Unit0 (MTU0 to MTU5)	Multi-Function Timer Pulse Unit 2 (MTU2a) Channlel 0 to 5
POE2a	POE2a	Port Output Enable 2 (POE2a)

TMR	Unit0 (TMR0 and TMR1)	8-Bit Timer (TMR) Unit 0 (Channlel 0 and 1)
	Unit1 (TMR2 and TMR3)	8-Bit Timer (TMR) Unit 1 (Channlel 2 and 3)
CMT	Unit0 (CMT0 and CMT1)	Compare Match Timer (CMT) Unit 0 (Channlel 0 and 1)
	Unit1 (CMT2 and CMT3)	Compare Match Timer (CMT) Unit 1 (Channlel 2 and 3)
RTCc	Realtime Clock (RTCc)	Realtime Clock (RTCc)
IWDTa	Independent Watchdog Timer (IWDTa)	Independent Watchdog Timer (IWDTa)
SCI	SCI 1, 5, 6, 9, 12	Serial Communications Interface SCIe(SCI1,5,6,9), SCIf(SCI12)
RIIC	RIIC0	I^2C Bus Interface (RIIC)
RSPI	RSPI0	Serial Peripheral Interface (RSPI)
CRC	CRC Calculator (CRC)	CRC Calculator (CRC)
S12ADb	S12AD0	12-Bit A/D Converter (S12ADb)
CMPA	Comparator A (CMPA)	Comparator A (CMPA)
DOC	Data Operation Circuit (DOC)	Data Operation Circuit (DOC)

For how to set up the peripheral modules, refer to the user’s manual. For details on the setting of pin functions, refer to section 3.2, Pin Functions.

3.2 Pin Functions (Multifunction Pin Controller)

The multifunction pin controller (MPC) in RX220-group MCUs selects the functions to be assigned to individual pins. The Peripheral Driver Generator provides a pin-function pane through which settings for the MPC can be made.

Select the [SYSTEM] tab from the peripheral-module selection tabs and click on [Pin (Multi function pin controller)] in the resource pane to open the pin-function pane.

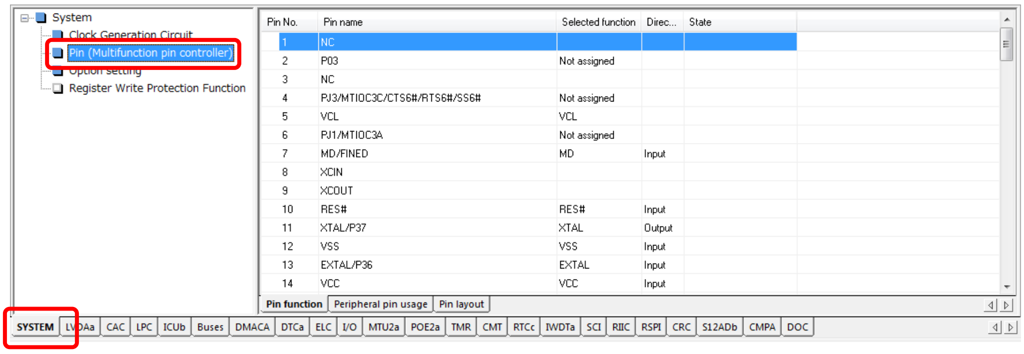


Figure 3.2 Opening the Pin-Function Pane

The pin-function pane has [Pin function] and [Peripheral pin usage] sheets. The two sheets are linked, so that settings can be made in either of them.

3.2.1 [Pin function] Sheet

(1) Configuration

The [Pin function] sheet shows all of the MCU pins in order and the functions that have been assigned to those pins. This sheet can be used to select functions for each of the pins with multiplexed functions.

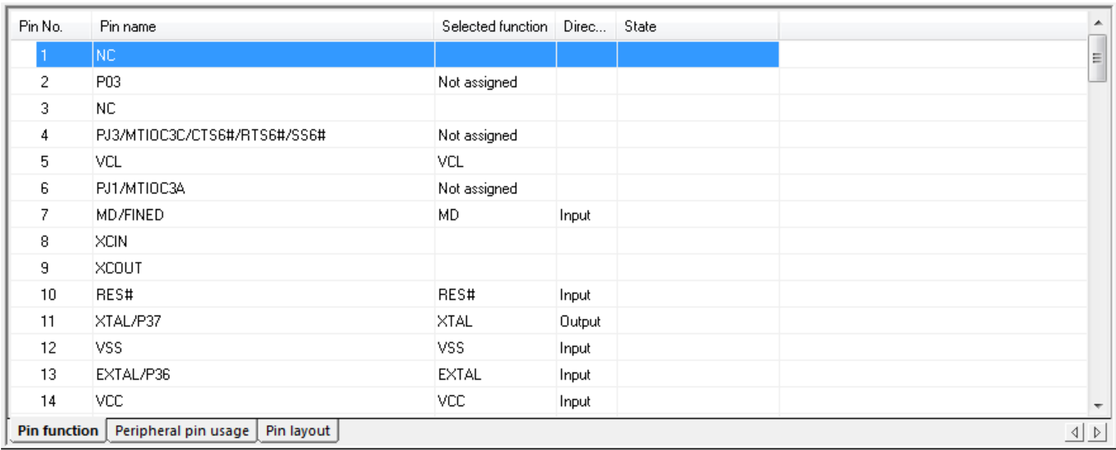


Figure 3.3 Pin-Function Pane ([Pin function] Sheet)

The contents of each column are shown in table 3.2.

Table 3.2 Columns on the [Pin function] Sheet

Column	Description
Pin No.	Pin number
Pin name	Name of the pin (which shows all of the functions assigned to that pin)
Selected function	Currently allocated pin function
Direction	Whether the pin function is an input or output
State	Warning or error message, if any

(2) Default State

By default (i.e. when no pins have been set up for use with peripheral modules), “Not assigned” is shown in the [Selected function] column for each port pin, indicating that no function has yet been selected (figure 3.4).

Figure 3.4 [Pin function] Sheet in the Default State (100-Pin LQFP Package)

Note:

Port pins of RX220-group MCUs are general-purpose input port pins by default. Even though “Not assigned” is shown in the [Selected function] column for each port pin by default (i.e. when no pins have been set up for use with peripheral modules), the pin will act as a general-purpose input port pin. When you designate a pin as a general-purpose input port pin in the [I/O] pane, the name of the general-purpose input port pin will appear in the [Selected function] column (figure 3.5(b)).

(a) Default State

(b) After Designating P05 as a General-Purpose Input Port Pin in the [I/O] Pane

Figure 3.5 Display for Pin P05 (100-Pin LQFP Package)

(3) Selecting a Pin Function

When a pin has multiplexed functions, placing the mouse pointer on the [Selected function] column in the row for that pin brings up a drop-down button. Clicking on the button brings up a list of selectable pin functions (figure 3.6).

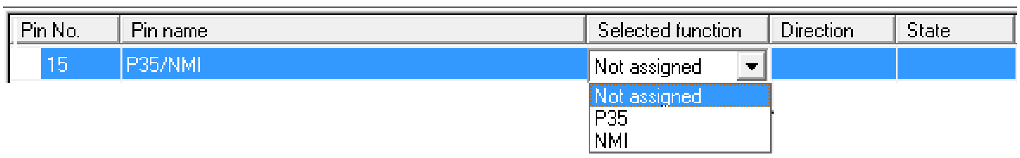


Figure 3.6 Selectable Pin Functions

In the default state (i.e. when no pins have been set up for use with peripheral modules), if [Selected function] is changed from “Not assigned” to another pin function, the warning [<Name of the pin function> has not been configured in the peripheral settings.] appears. For example, when [Selected function] for P35/NMI is changed from “Not assigned” to NMI despite the interrupt controller (ICUA) not being set up, a warning appears as shown in figure 3.7.

Pin No.	Pin name	Selected function	Direction	State
15	P35/NMI	NMI		NMI has not been configured in the peripheral settings.

Figure 3.7 Warning on Changing [Selected function] in the Default State

When the NMI has been set up in the [ICUA] pane, the warning disappears and “NMI” appears in the [Selected function] column.

Pin No.	Pin name	Selected function	Direction	State
15	P35/NMI	NMI	Input	

Figure 3.8 After Setting the NMI up

Note:
The generation of source files is still possible when the warning shown in figure 3.7 is being displayed, but the pin will not act as an NMI. For details, refer to section 3.2.4, Error Messages and Warnings on Pin Settings.

(4) Selecting a Pin Function before Setting up the Associated Peripheral Module
When a peripheral module is set up after selecting the pin functions on the [Pin function] sheet, the selected pin functions are automatically allocated to the pins.
IRQ5, for example, can be assigned to P15, PA4, PD5, or PE5 (P15, PA4, or PE5 for products in 64-pin packages, P15, or PA4 for productions in 48-pin packages). To assign IRQ5 to PE5, IRQ5 should be selected as the [Selected function] for PE5 on the [Pin function] sheet (figure 3.9).

Pin No.	Pin name	Selected function	Direction	State
73	PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	IRQ5		IRQ5 has not been configured in the peripheral settings.

Figure 3.9 IRQ5 Selected for PE5 (with the ICUA Not Set up)

When IRQ5 is set up in the [ICUA] pane, IRQ5 is actually assigned to PE5 (figure 3.10).

Pin No.	Pin name	Selected function	Direction	State
73	PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	IRQ5	Input	

Figure 3.10 IRQ5 Selected for PE5 (after the ICUA Has been Set up)

3.2.2 [Peripheral pin usage] Sheet

The [Peripheral pin usage] sheet shows which pins are used by the corresponding peripheral module. The pin functions associated with the peripheral module selected in the left section and where those functions are assigned are listed in the right section. If multiple pins are selectable for a specific function, the allocation can be changed through this sheet.

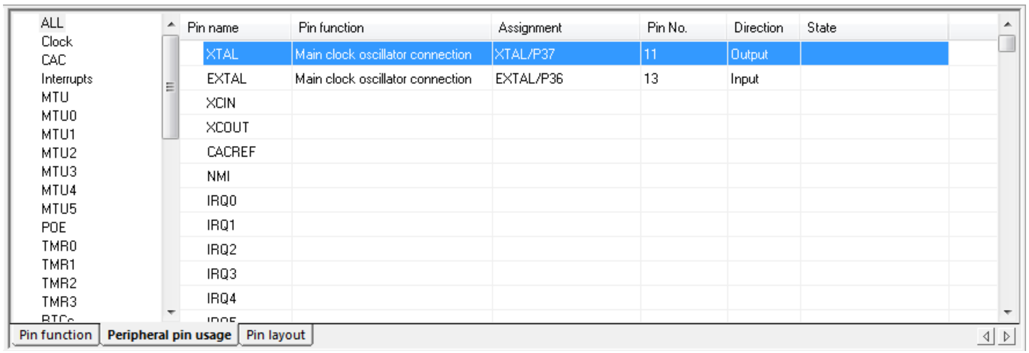


Figure 3.11 Pin-Function Pane ([Peripheral pin usage] Sheet)

Table 3.3 lists the columns on the [Peripheral pin usage] sheet.

Table 3.3 Columns on the [Peripheral pin usage] Sheet

Column	Contents
Pin Name	Names of pins used by the peripheral module selected in the left section
Pin Function	Pin function
Assignment	Full name of the MCU pin, showing all of the functions assigned to that pin
Pin No.	Pin number
Direction	Input or output
State	Warning or error message, if any

(1) Default State

By default (i.e. when no pins have been set up for use with peripheral modules), the [Pin Function] and [Assignment] columns are blank (figure 3.12).

Figure 3.12 [Peripheral pin usage] Sheet in the Default State

(2) Assigning a Pin Function to a Port Pin

When a peripheral module associated with input to or output from pins has been set up, the pin functions to be used by that peripheral module are assigned to the corresponding port pins and the current settings are shown on the [Peripheral pin usage] sheet. If you have set up external interrupt IRQ0 in the detailed settings pane, for example, pin IRQ0 is assigned to P30 and the [Peripheral pin usage] sheet shows the setting of IRQ0 as follows.

Figure 3.13 Display of a Pin Function Assigned to a Port Pin (Example)

Note:
When a peripheral module is set up in the default state (i.e. when no pin functions have been selected on the [Pin function] or [Peripheral pin usage] sheet), the pin functions for that peripheral module are assigned to the port pins listed in the "Allocation in the Default State" section of appendix 1, Pin Functions for which the Allocation Can be Changed. When the allocation of pin functions has been designated on the [Pin function] sheet before a peripheral module is set up, the pin functions are assigned to the selected port pins.

Subsequently setting up general-purpose I/O port pin P30, which uses the same pin as IRQ0, in the [I/O] pane will cause a conflict and a warning will be output as shown in figure 3.14.

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	P30/MTIOC4B/TMRI3/POE8#/..	20	Input	Conflicting with another pin function.

Figure 3.14 Warning of a Conflict between Pin Functions

Note:
Even if two or more pin functions are assigned to a single pin (as in figure 3.14), generating source files is still possible. You can switch between the functions, although more than one cannot be in use at the same time. For details, refer to section 3.2.4, Error Messages and Warnings on Pin Settings.

The allocation of IRQ0 can be changed. Other pins to which IRQ0 can be assigned are selectable from a drop-down list box. Placing the mouse pointer on the [Assignment] column brings up a drop-down button.

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	P30/MTIOC4B/TMRI3/POE8	20	Input	Conflicting with another pin function.

Figure 3.15 Drop-Down Button

Click on the drop-down button and select one of the options displayed in the list box.

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	P30/MTIOC4B/TMRI3/POE8	20	Input	Conflicting with another pin function.

P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0-DS/RTCIC0
PD0/IRQ0
PH1/TMO0/IRQ0

Figure 3.16 Changing the Allocation of a Pin Function

If IRQ0 is assigned to PH1 and that pin is not being used for any other peripheral module, the conflict between P30 and IRQ0 can be resolved.

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	PH1/TMO0/IRQ0	37	Input	

Figure 3.17 Display after Changing the Allocation

The pin functions for which you can select the assignment are listed in appendix 1, Pin Functions for which the Allocation Can be Changed.

Note:
When the peripheral module has not been set up (as in figure 3.12), the allocation of pin functions cannot be changed through this sheet.

3.2.3 Peripheral-Module Settings Shared between the [Pin function] and [Peripheral pin usage] Sheets

A change to a setting on either the [Pin function] or [Peripheral pin usage] sheet is reflected on the other sheet. When the allocation of a pin function is changed on the [Pin function] sheet, that change also applies to the [Peripheral pin usage] sheet, and vice versa (figure 3.18).

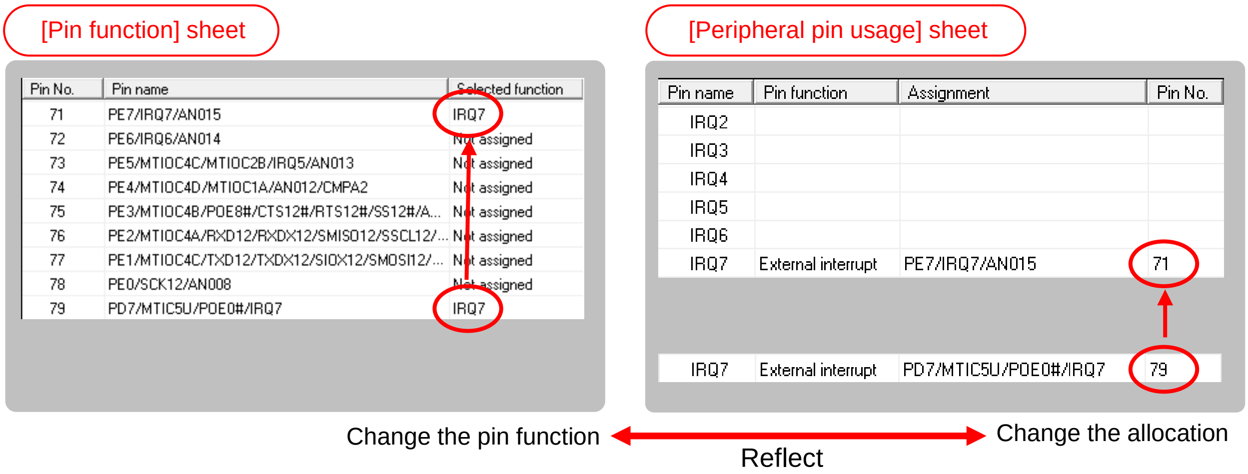


Figure 3.18 Linking of the [Pin function] and [Peripheral pin usage] Sheets

The current settings for each peripheral module are reflected on the [Pin function] and [Peripheral pin usage] sheets. When IRQn is set up in the [ICUA] pane, for example, the [Peripheral pin usage] sheet shows that IRQn is in use and the allocation of IRQn is displayed on the [Pin function] and [Peripheral pin usage] sheets. When the setting for IRQn in the [ICUA] pane is canceled, the allocation of IRQn is canceled on the [Pin function] and [Peripheral pin usage] sheets.

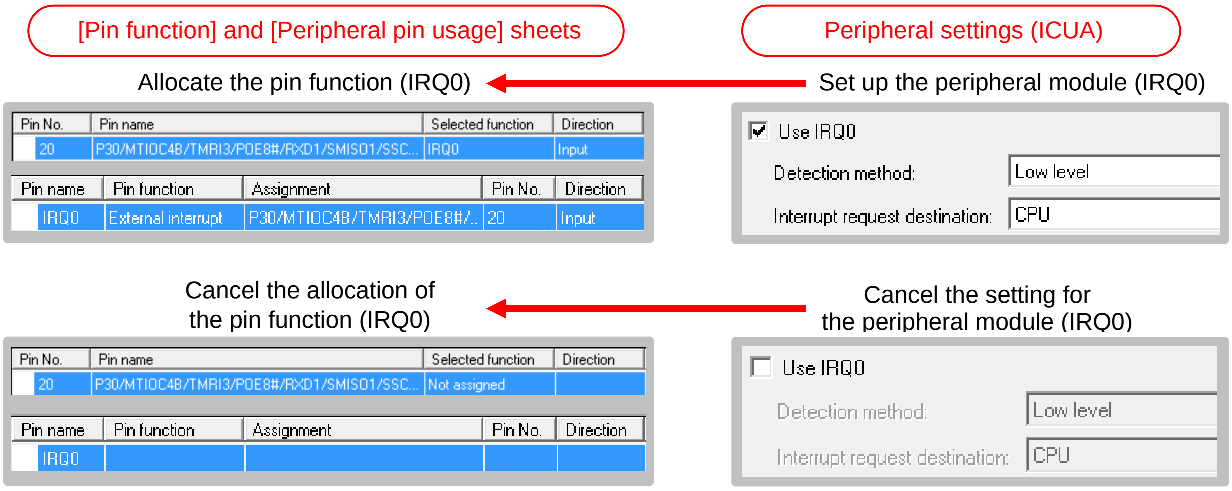


Figure 3.19 Setting up a Peripheral Module and Allocating Pin Functions

On the other hand, a change made on the [Pin function] or [Peripheral pin usage] sheet is not reflected on the detailed-settings pane for the peripheral module. Even if [Selected function] for IRQn is changed to "Not assigned" on the [Pin function] sheet after IRQn has been set up in the [ICUA] pane, for example, the setting of IRQn in the [ICUA] pane is not canceled. Since no pin is assigned to IRQn in this case, an error message appears. For details on the error messages, refer to section 3.2.4, Error Messages and Warnings on Pin Settings.

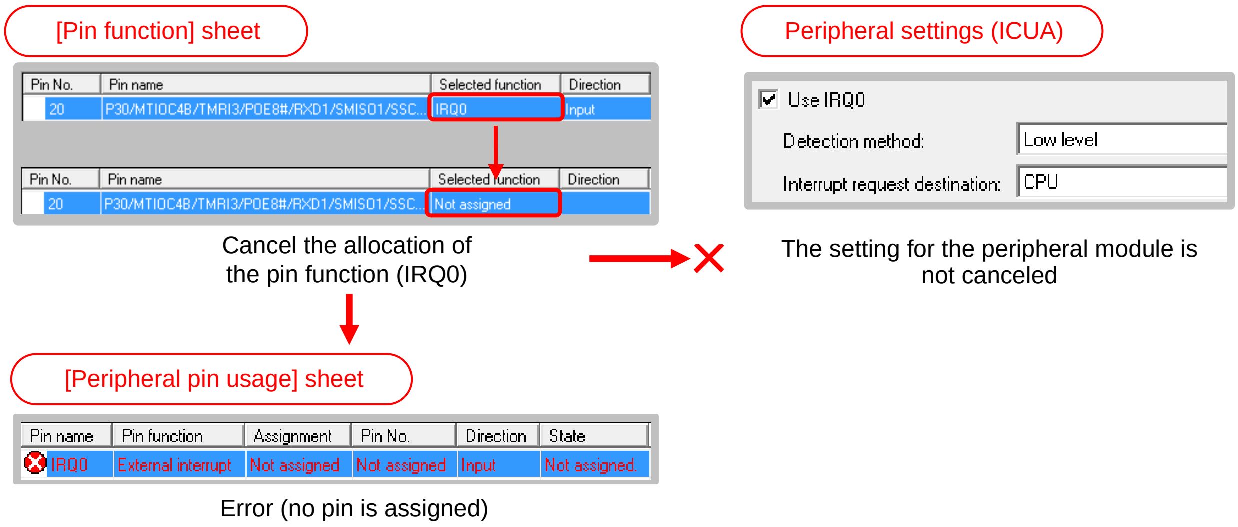


Figure 3.20 Canceling the Allocation of a Pin Function Leading to Display of an Error Message

3.2.4 Error Messages and Warnings on Pin Settings

When an incorrect setting is made, an error message or warning is displayed on the [Pin function] or [Peripheral pin usage] sheet. The errors and warnings are listed in table 3.4.

Table 3.4 Errors and Warnings

Cause	Type	Message
A single pin function has been selected for multiple pins.	Error	"The same function is assigned to <*pin numbers*>." ([Pin function] sheet) "Do not assign a single function to multiple pins." ([Peripheral pin usage] sheet)
The pin function has not been allocated.	Error	"Not assigned" ([Peripheral pin usage] sheet)
Multiple pin functions have been selected for a single pin.	Warning	"Conflicting between different functions." ([Pin function] sheet) "Conflicting with another pin function." ([Peripheral pin usage] sheet)
Conflict with use of a pin by a debugger	Warning	"Conflicting with an on-chip emulator pin." ([Pin function] sheet) "Conflicting between a peripheral module pin and an on-chip emulator pin." ([Peripheral pin usage] sheet)
The peripheral module has not been set up.	Warning	"<*pin function*> has not been configured in the peripheral settings." ([Pin function] sheet)

Details of the errors and warnings are given below.

(1) A single pin function has been selected for multiple pins.

Selecting a single pin function for multiple pins leads to an error that prevents the generation of source files.
In this case, allocate another pin function to either of the pins, change the entry on the [Pin function] sheet to “Not assigned”, or re-select the allocation of the pin function on the [Peripheral pin usage] sheet.

Pin No.	Pin name	Selected function	Direction	State
20	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSC...	IRQ0	Input	The same function is assigned to 20/86.
86	PD0/IRQ0	IRQ0	Input	The same function is assigned to 20/86.

(a) [Pin function] Sheet

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	Conflicted	20/86	Input	Do not assign a single function to multiple pins.

(b) [Peripheral pin usage] Sheet

Figure 3.21 Example of an Error (Selection of a Single Function for Multiple Pins)

(2) The pin function has not been allocated.

Failure to allocate a pin function required by a peripheral module leads to an error and prevents the generation of source files.
Select the pin function for a corresponding pin on the [Pin function] sheet or designate the allocation of the pin function on the [Peripheral pin usage] sheet.

Pin name	Pin function	Assignment	Pin No.	Direction	State
IRQ0	External interrupt	Not assigned	Not assigned	Input	Not assigned.

[Peripheral pin usage] Sheet

Figure 3.22 Example of an Error (Pin Function not Allocated)

(3) Multiple pin functions have been selected for a single pin.

A warning appears when two or more pin functions have been assigned to a single pin (as in figure 3.23), but generating source files is still possible. You can switch between the functions, although they cannot be used at the same time.
To switch between pin functions, make the initial setting for the peripheral module using that pin function, since the individual pin functions are set by the initial-setting function for the given peripheral module.
However, RTCOUT and RTCIC2 cannot be assigned to the same pin.

Pin No.	Pin name	Selected function	Direction	State
⚠ 20	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSC...	P30/IRQ0		Conflicting between different functions.

(a) [Pin function] Sheet

Pin name	Pin function	Assignment	Pin No.	Direction	State
⚠ IRQ0	External interrupt	P30/MTIOC4B/TMRI3/...	20	Input	Conflicting with another pin function.

Pin name	Pin function	Assignment	Pin No.	Direction	State
⚠ P30	General input port	P30/MTIOC4B/TMRI3/...	20	Input	Conflicting with another pin function.

(b) [Peripheral pin usage] Sheet

Figure 3.23 Example of a Warning (Multiple Pin Functions Selected for a Single Pin)

(4) Conflict with use of a pin by a debugger

A warning appears when a pin function for a peripheral module has been allocated to a pin for use by an on-chip debugger. Generating source files is still possible. Note, however, that the other pin function allocated to the pin may not be usable while the on-chip debugger is in use.

Pin No.	Pin name	Selected function	Direction	State
⚠ 21	P27/MTIOC2B/TMCI3/SCK1	TMCI3		Conflicting with an on-chip emulator pin.

(a) [Pin function] Sheet

Pin name	Pin function	Assignment	Pin No.	Direction	State
⚠ TMCI3	Counter clock input	P27/MTIOC...	21	Input	Conflicting between a peripheral module pin and an on-chip emulator pin.

(b) [Peripheral pin usage] Sheet

Figure 3.24 Example of a Warning (Conflict with Use of a Pin by a Debugger)

(5) The peripheral module has not been set up.

A warning appears when a pin function is selected on the [Pin function] sheet but the corresponding peripheral module has not been set up. Although generating source files is still possible, the selected pin function will not be usable. To enable the selected pin function, set up the peripheral module that is to use the function and call the initial-setting function, which sets the registers to change the pin function.

Pin No.	Pin name	Selected function	Direction	State
⚠ 20	P30/MTIOC4B/TMRI3/POE8...	IRQ0		IRQ0 has not been configured in the peripheral settings.

[Pin function] Sheet

Figure 3.25 Example of a Warning (Peripheral Module Not Set up)

3.3 Endian

Select the [SYSTEM] tab from the peripheral-module selection tabs and click on [Option setting] in the resource pane to open the endian setting pane.

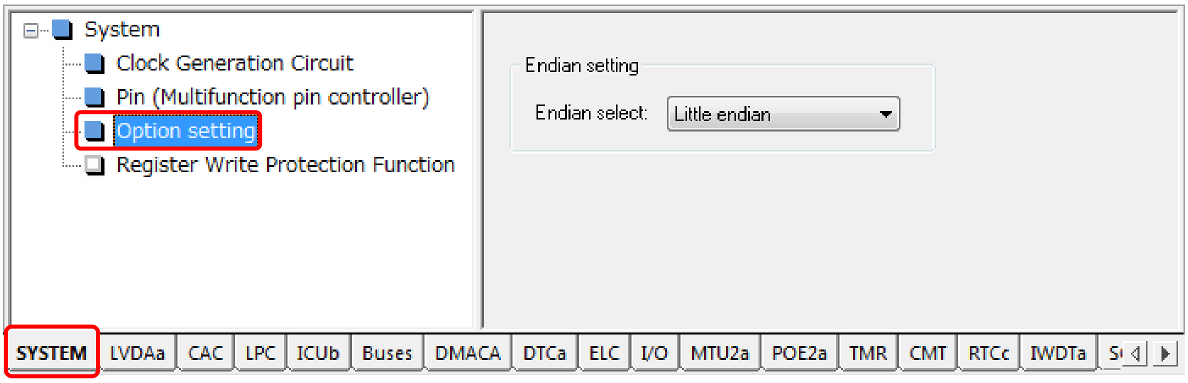


Figure 3.26 The setting method of endian

Select endian to be used here. This setting is only used for selecting Renesas Peripheral Driver Library files (xxx_little.lib or xxx_big.lib) to be linked and thus does not affect the output source code.

4. Tutorial

This section introduces the usage of the Peripheral Driver Generator by giving instructions on how to use the Peripheral Driver Generator and High-performance Embedded Workshop to create a tutorial program that implements the following operations on the Renesas Starter Kit board for the RX220.

・ An LED blinking on a 8-bit timer (TMR) interrupt
・ An LED blinking on the PWM output of the multi-function timer pulse unit 2 (MTU2a)
・ Continuously scanning on 12-Bit A/D converter (S12ADb)
・ Triggering DTCa by ICUb
・ Data transfer between SCIe channels 0 and 5

The labels given below respectively indicate operations to take place in the Peripheral Driver Generator and in the High-performance Embedded Workshop.

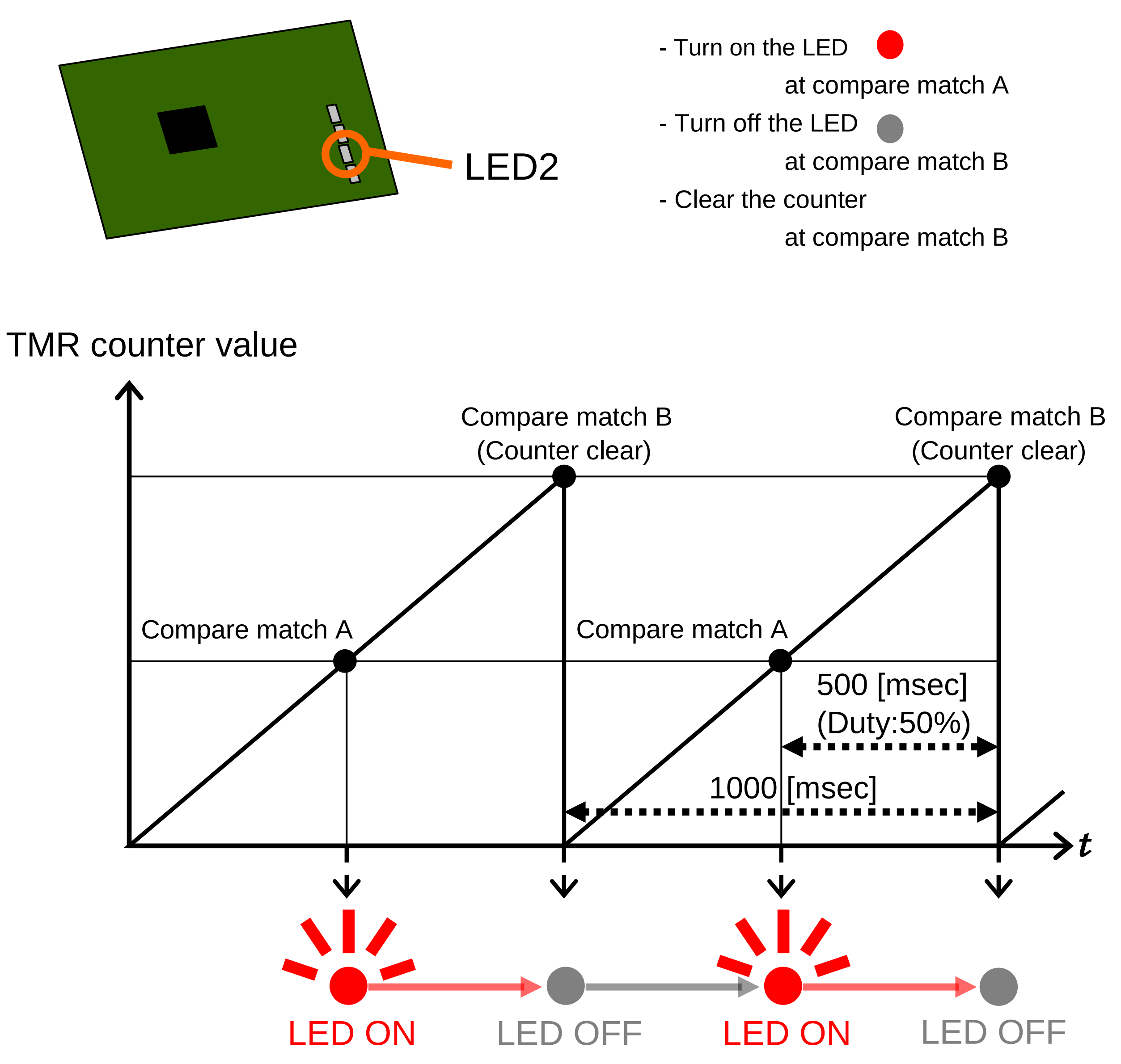
PDG	: Operations in the Peripheral Driver Generator
HEW	: Operations in the High-performance Embedded Workshop

4.1 An LED blinking on a 8-bit timer (TMR) interrupt

The LED2 on RSK board is connected to P16. In this tutorial, 8-bit Timer and I/O port will be set up to blink this LED as follows.

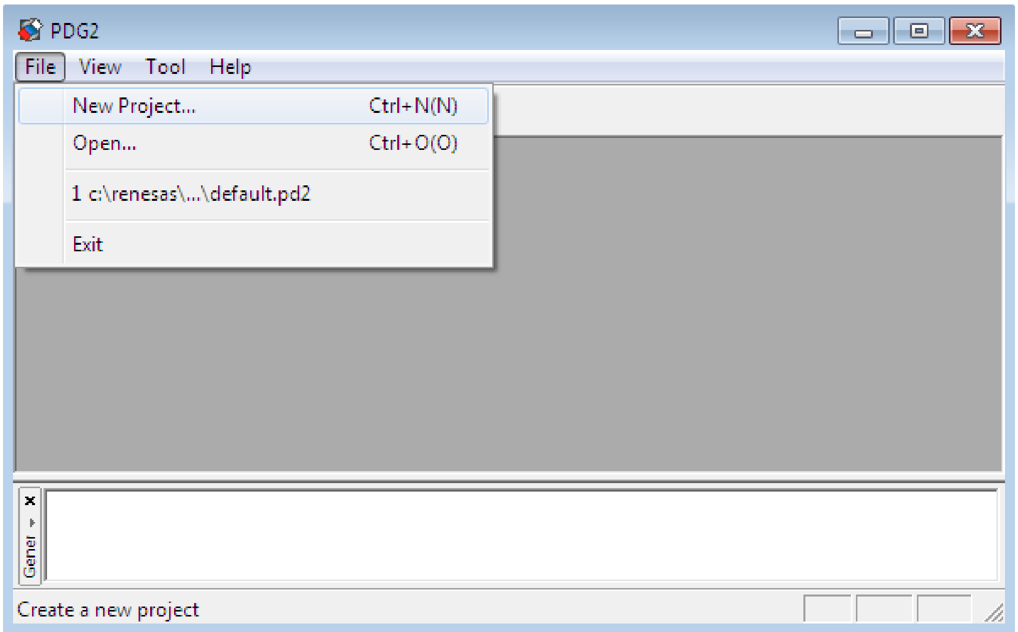
Note : If there is a switch that enables/disables P16 on the RSK board, enable it.

The LED2 turns on when the output from P16 is 0, and turns off when the output is 1.



(1) Making the Peripheral Driver Generator project **PDG**

1. Start the Peripheral Driver Generator.
2. Select [File]->[New Project] menu.

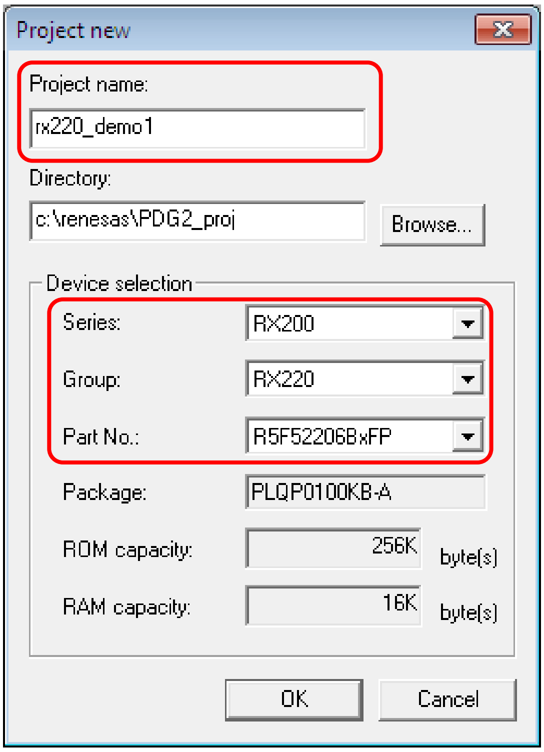


3. Specify "rx220_demo1" as the project name.

Set the CPU type as follows.

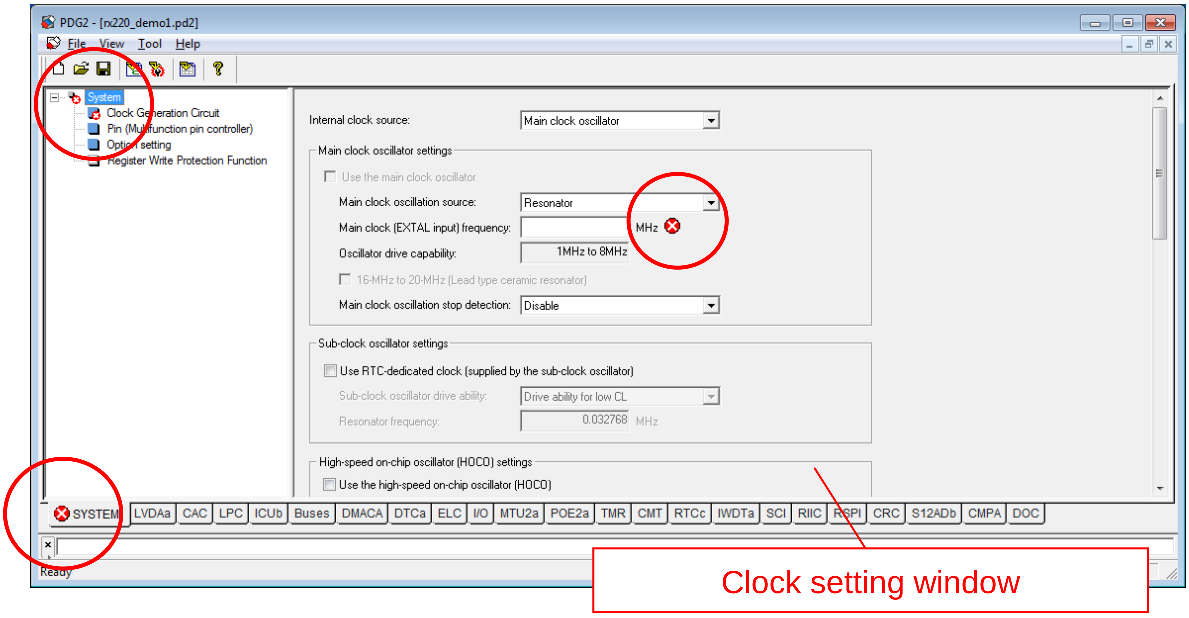
Series : RX200
Group : RX220
Part No. : R5F52206BxFP

Note: If another type of chip is mounted on your RSK board, select corresponding CPU type.

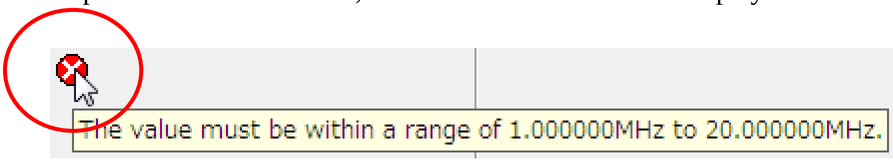


(2) Initial state **PDG**

-The clock setting window opens and the error icons are displayed in the initial state.



Place the mouse pointer on the error icon, then the contents of error is displayed.



There are 3 types of icons in Peripheral Driver Generator

Error

The setting is not allowed.

The source filese cannot be generated if there is an error setting.

Warning

The setting is possible but may be wrong.

Source files can be generated.

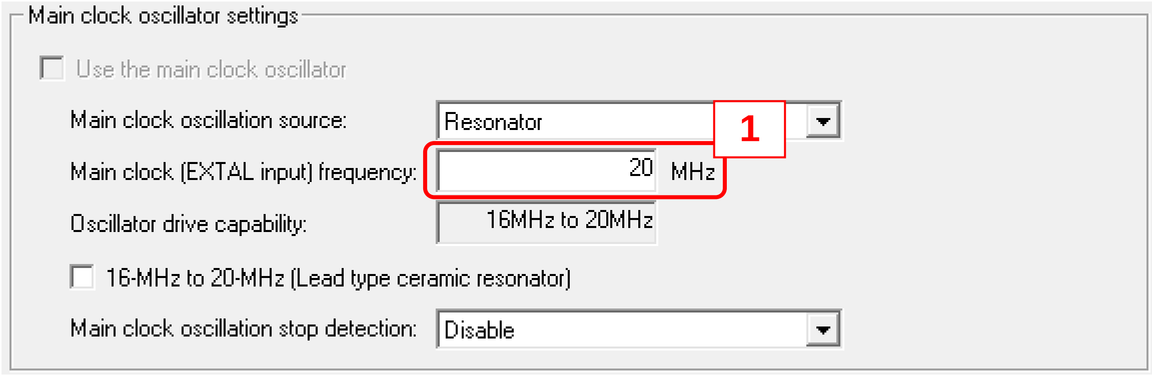
Information

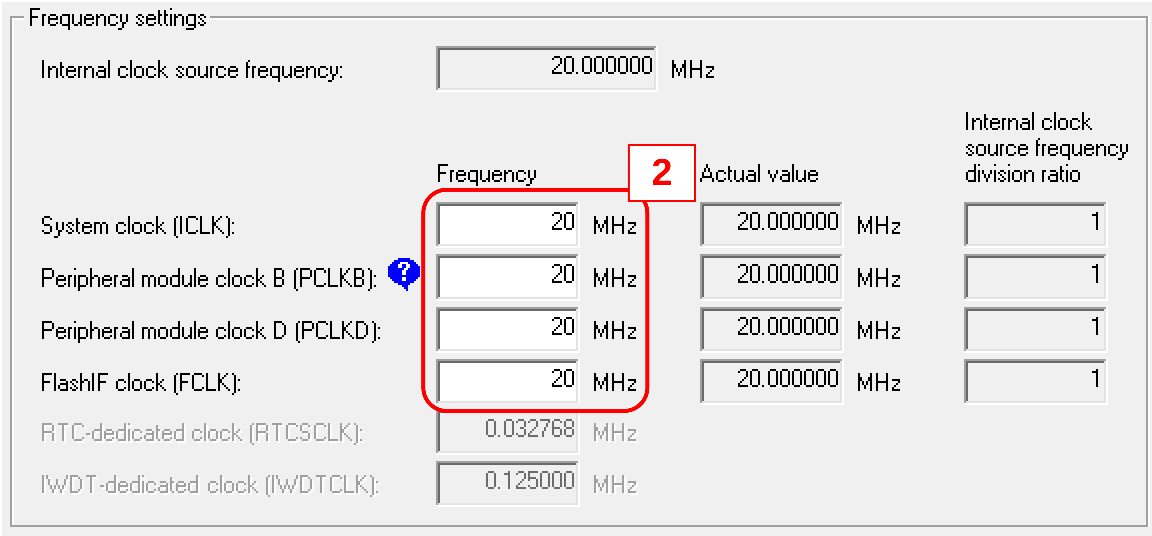
Additional information for the complex setting.

Only icons on the setting window can display the tooltip.

(3) Clock setting **PDG**

1. It is necessary to set the main (EXTAL) clock frequency first.
   External clock frequency of the RSK board is 20 MHz. Set 20 to the edit box.
2. ICLK, PCLKB, PCLKD and FCLK are used in 20 MHz.
   Set 20 to the edit box.





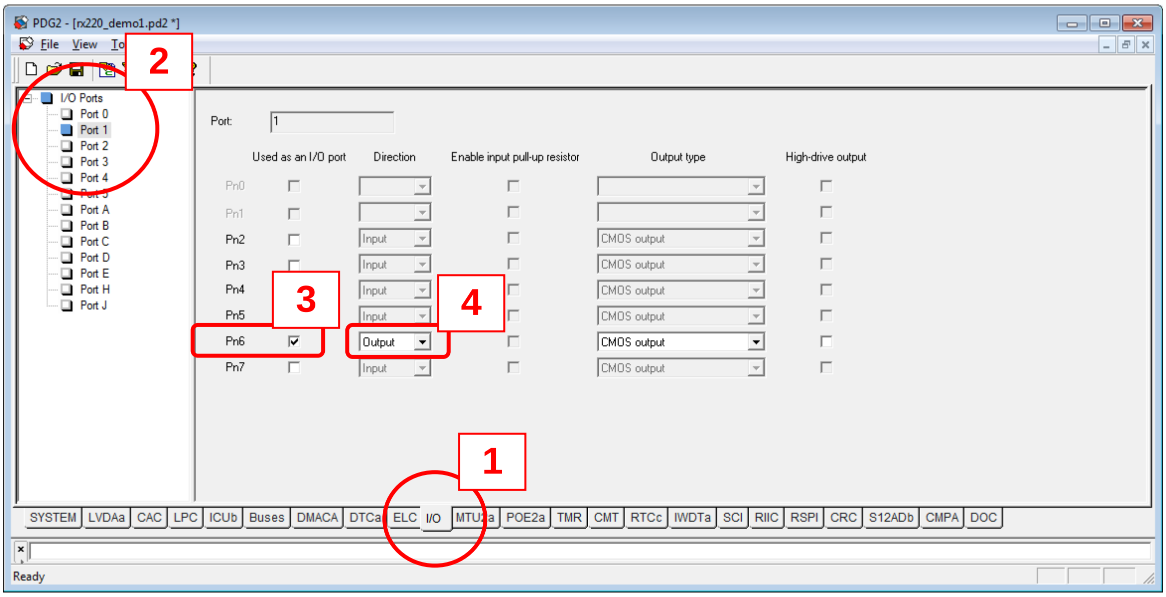
(4) Endian setting **PDG**

For the endian setting, refer to section 3.3, Endian.

(5) I/O Port setting **PDG**

The LED2 on RSK is connected to P16 so set P16 to output port.

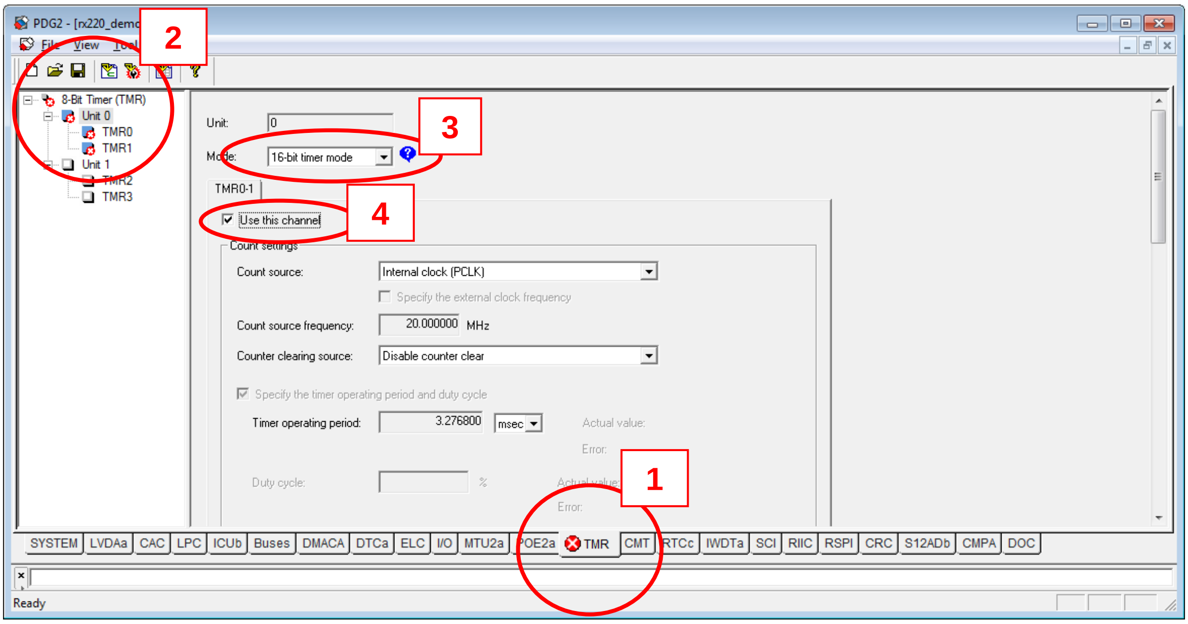
1. Select “I/O” tab
2. Select “Port 1”
3. Check “Pn6”
4. Select “Output”



(6) TMR setting-1 **PDG**

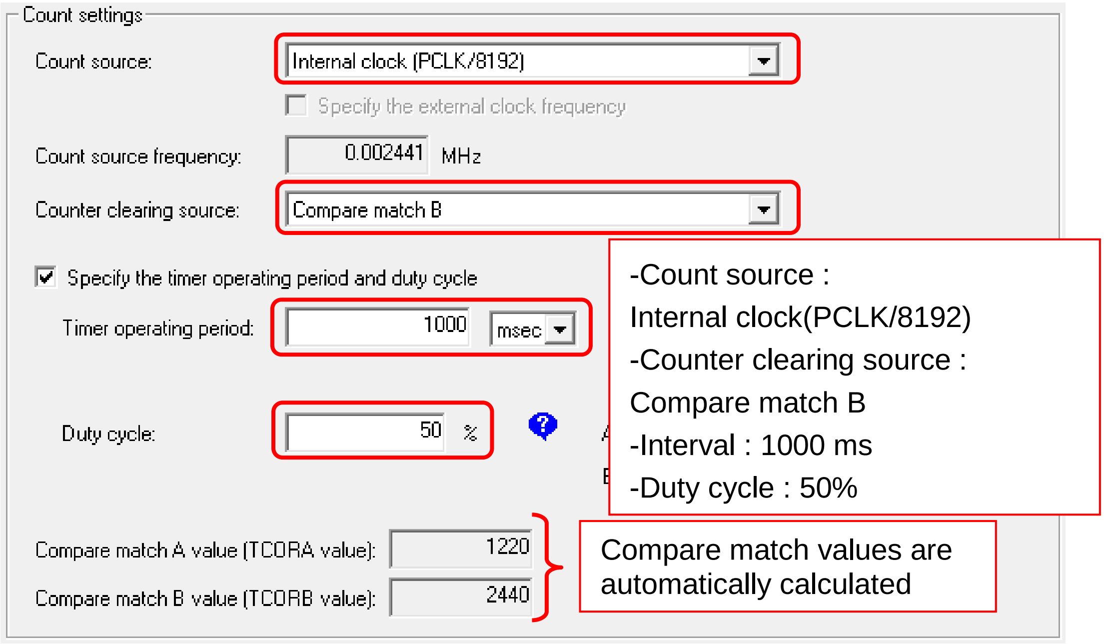
In this tutorial, TMR (8-bit timer) Unit0 is used in 16 bit mode (two 8-bit timers cascade connection)

1. Select "TMR" tab
2. Select "Unit0"
3. Select "16 bit timer mode"
4. Check "Use this channel"



(7) TMR setting-2 **PDG**

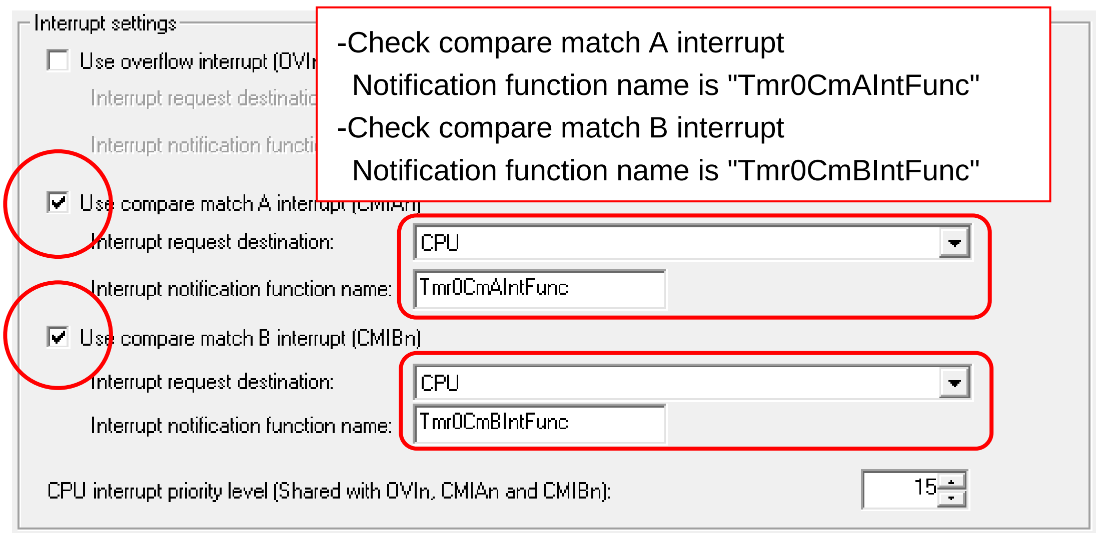
Set the other items as follows.



(8) TMR setting-3 **PDG**

Set the interrupt notification functions.

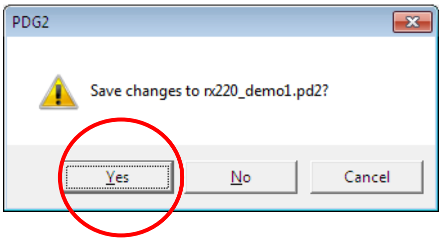
These functions are called when the interrupt occurs.



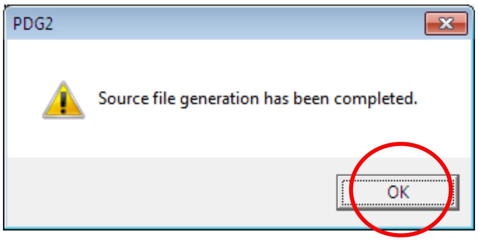
(9) Generating source files **PDG**

1. To generate source files, click  on the tool bar.

2. Save confirmation dialog box is displayed. Click [Yes].

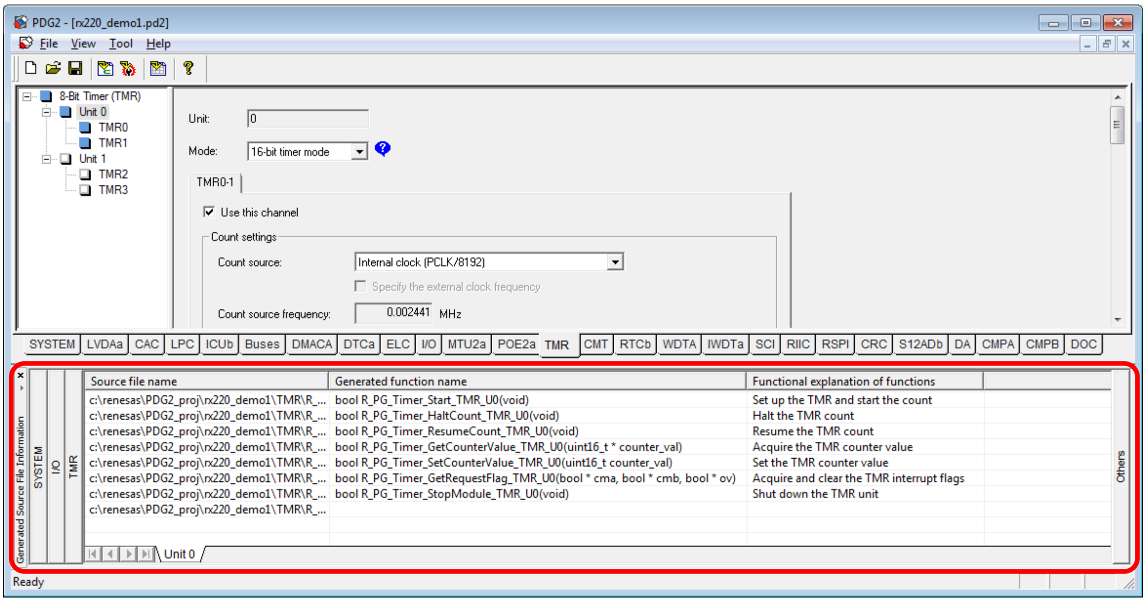


3. Click [OK] on the message box.



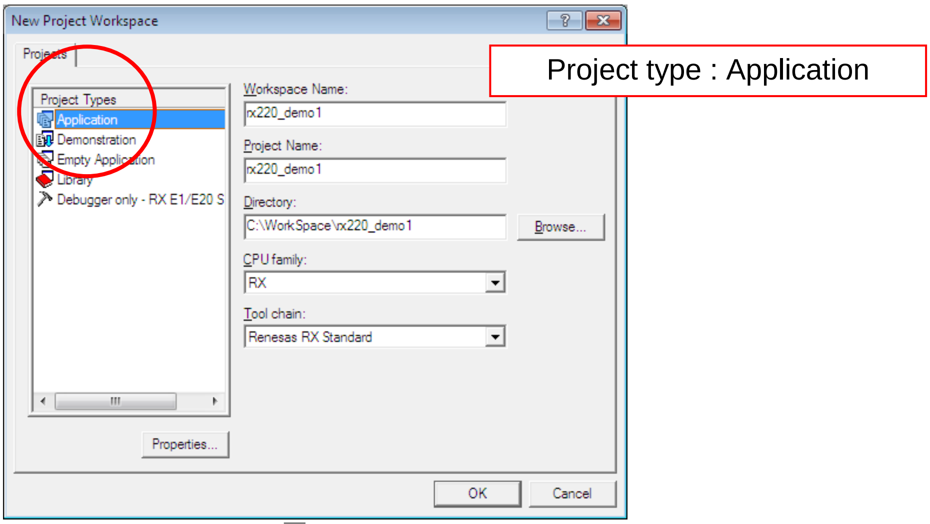
4. Generated functions are listed in lower pane.

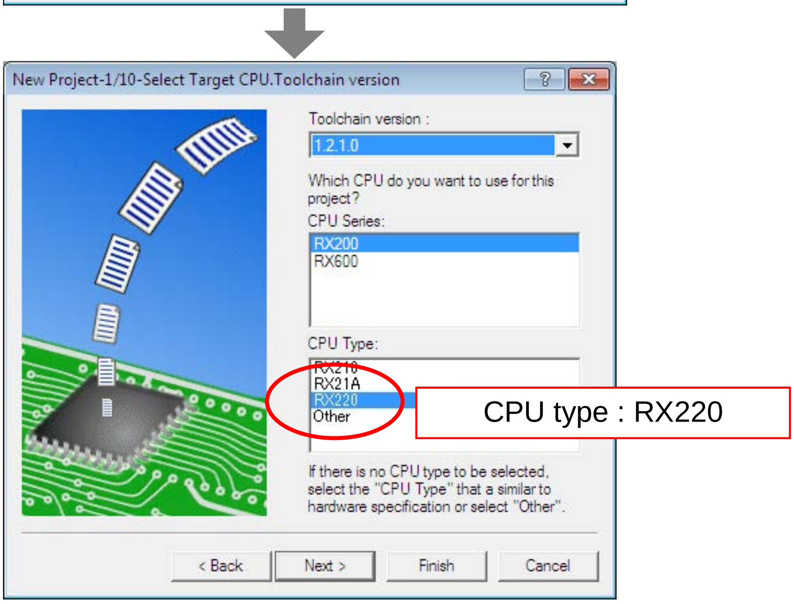
By double clicking the line of function, source file can be opened.

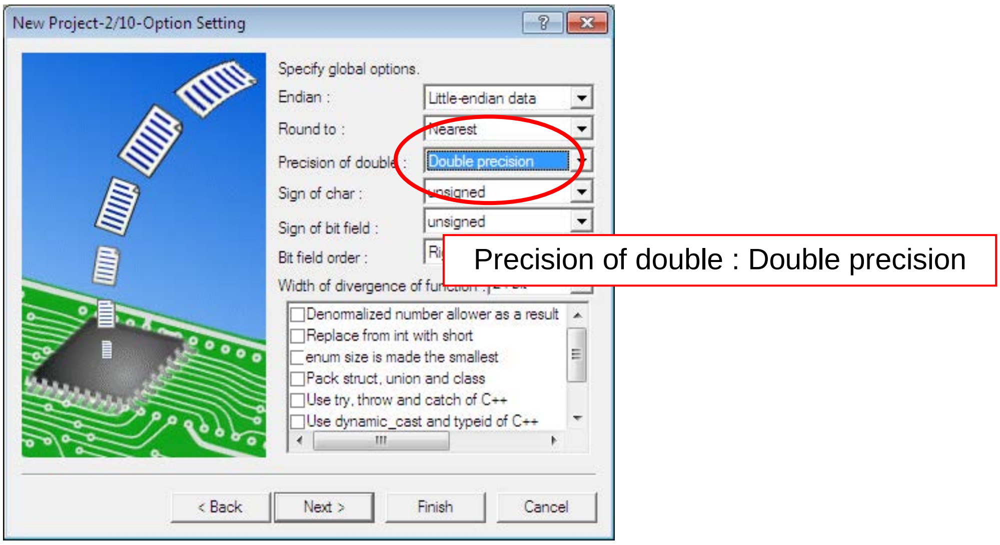


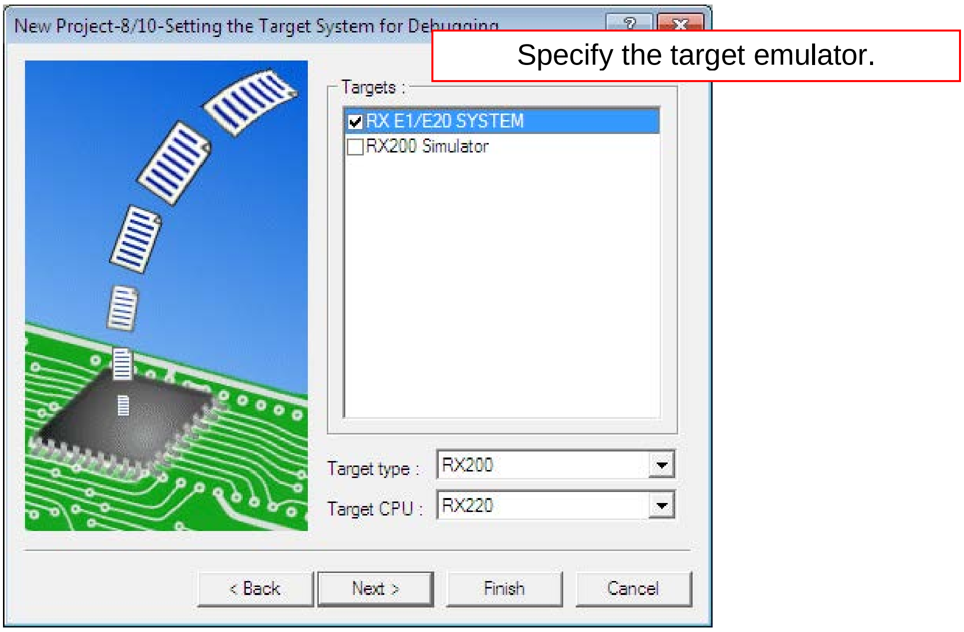
(10) Preparing the High-performance Embedded Workshop project **HEW**

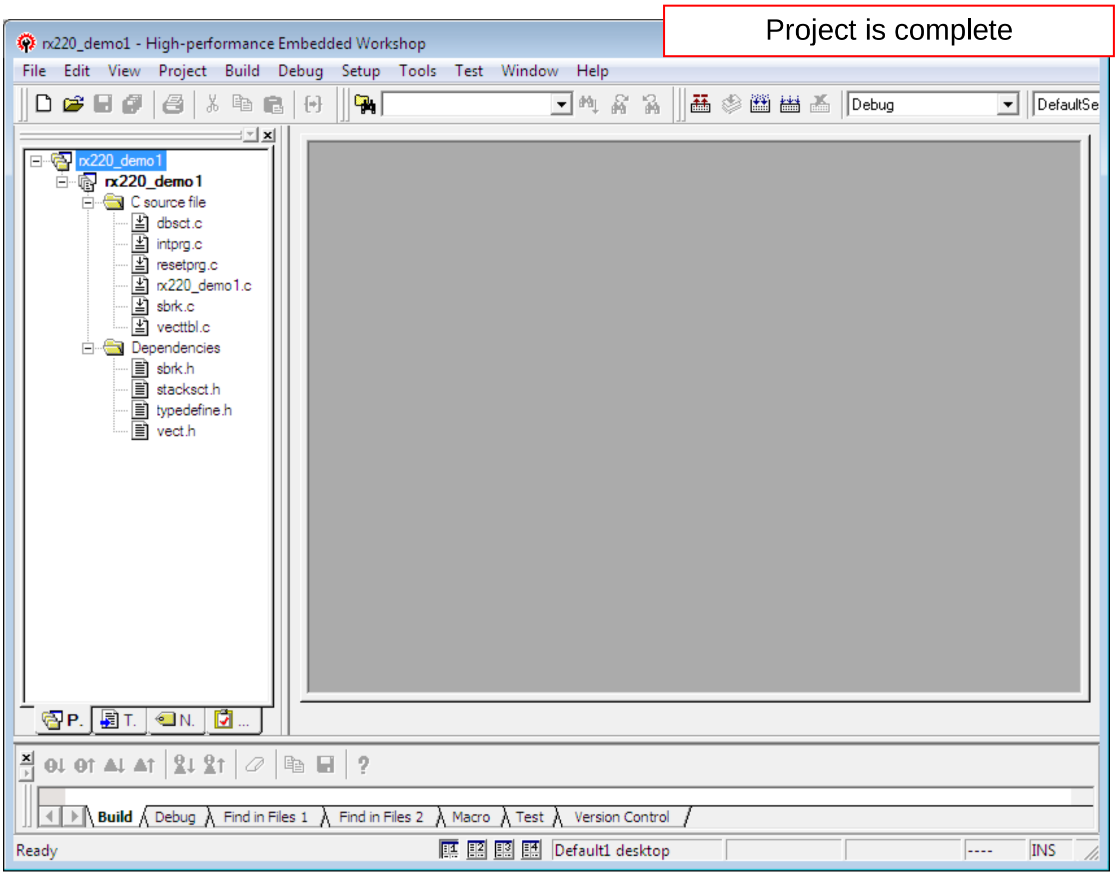
Start the High-performance Embedded Workshop and make RX220 workspace.








New Project-8/10-Setting the Target System for Debugging
Specify the target emulator.
Targets :
RX E1/E20 SYSTEM
RX200 Simulator
Target type :
RX200
Target CPU :
RX220
< Back
Next >
Finish
Cancel


rx220_demo1 - High-performance Embedded Workshop
Project is complete
File Edit View Project Build Debug Setup Tools Test Window Help
Debug
rx220_demo1
rx220_demo1
C source file
dbsct.c
intprg.c
resetprg.c
rx220_demo1.c
sbrk.c
vecttbl.c
Dependencies
sbrk.h
stacksct.h
typedefine.h
vect.h
Build
Debug
Find in Files 1
Find in Files 2
Macro
Test
Version Control
Ready
Default1 desktop
INS

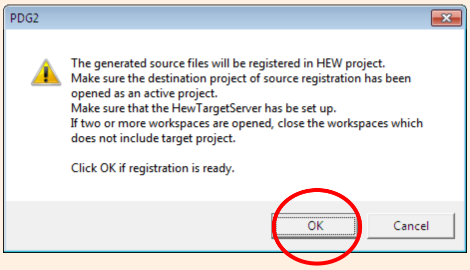
(11) Adding the generated source files to the High-performance Embedded Workshop project

PDG

1.To add source files to High-performance Embedded Workshop,

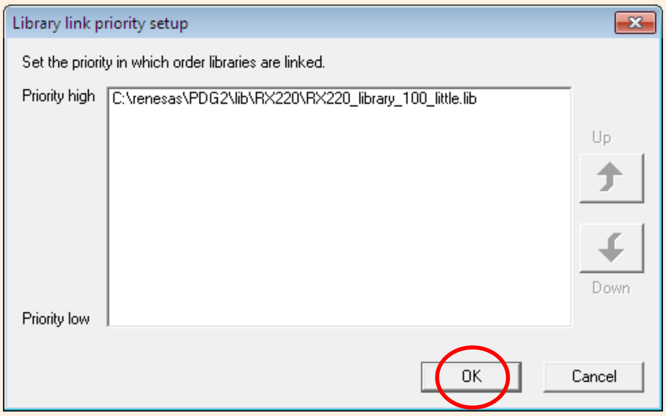
click  on the tool bar.

2. Click [OK] on the confirmation dialog box.



3. This is a linkage setting of Renesas Peripheral Driver Library.

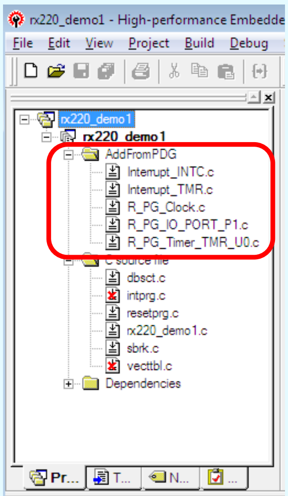
When using multiple lib files, linkage order can be set in this dialog box.



HEW

4. Source files are added to High-performance Embedded Workshop

Added source files are put in "AddFromPDG" folder.



Source files are registered via HEW Target Server.
Make sure that the HEW Target Server has been set up before executing registration.
For details, refer Peripheral Driver Generator user’s manual.

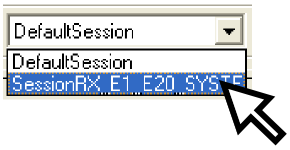
(12) Making the program on High-performance Embedded Workshop **HEW**

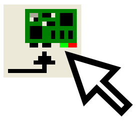
By changing the part of “main” function, make the following program on High-performance Embedded Workshop.

```
//Include "R_PG_<project name>.h"
#include "R_PG_rx220_demo1.h"

void main(void)
{
	//Configure I/O port pins that are not available
//	R_PG_IO_PORT_SetPortNotAvailable();

	//Set up the clock
	R_PG_Clock_Set();

	//Set up port P16
	R_PG_IO_PORT_Write_P16(1);
	R_PG_IO_PORT_Set_P1();

	//Set up TMR Unit0 and start count
	R_PG_Timer_Start_TMR_U0();

	while(1);
}

// Compare match A interrupt notification function
void Tmr0CmAIntFunc(void)
{
	// Turn on the LED
	R_PG_IO_PORT_Write_P16(0);
}

// Compare match B interrupt notification function
void Tmr0CmBIntFunc(void)
{
	// Turn off the LED
	R_PG_IO_PORT_Write_P16(1);
}
```

(13) Connecting to the emulator, building the program and executing **HEW**

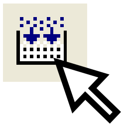
1. Connect to the emulator





Connect button

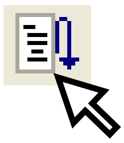
2. Just by clicking [Build] button, program can be built because Renesas Peripheral Driver Library and include directory are automatically registered in build setting.



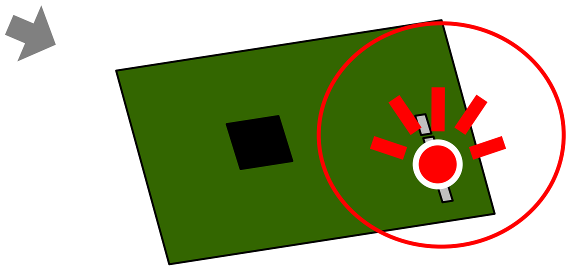
Build button

3. Download the program

4. Execute the program and see the LED on RSK board.



Reset go button

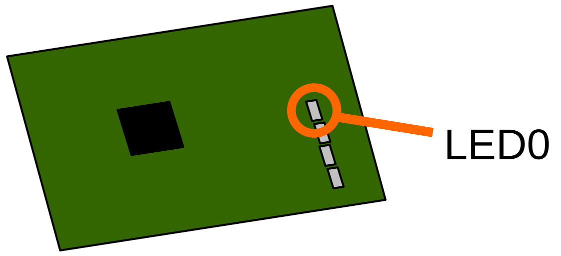


4.2 An LED blinking on the PWM output of the multi-function timer pulse unit 2 (MTU2a)

The LED0 on RSK board is connected to P14. This port can also be used as PWM output pin (MTIOC3A) of the multi-function timer pulse unit 2. In this tutorial, the multi-function timer pulse unit 2 will be set up to operate in PWM mode 1 and the PWM output will blink the LED0 as follows.

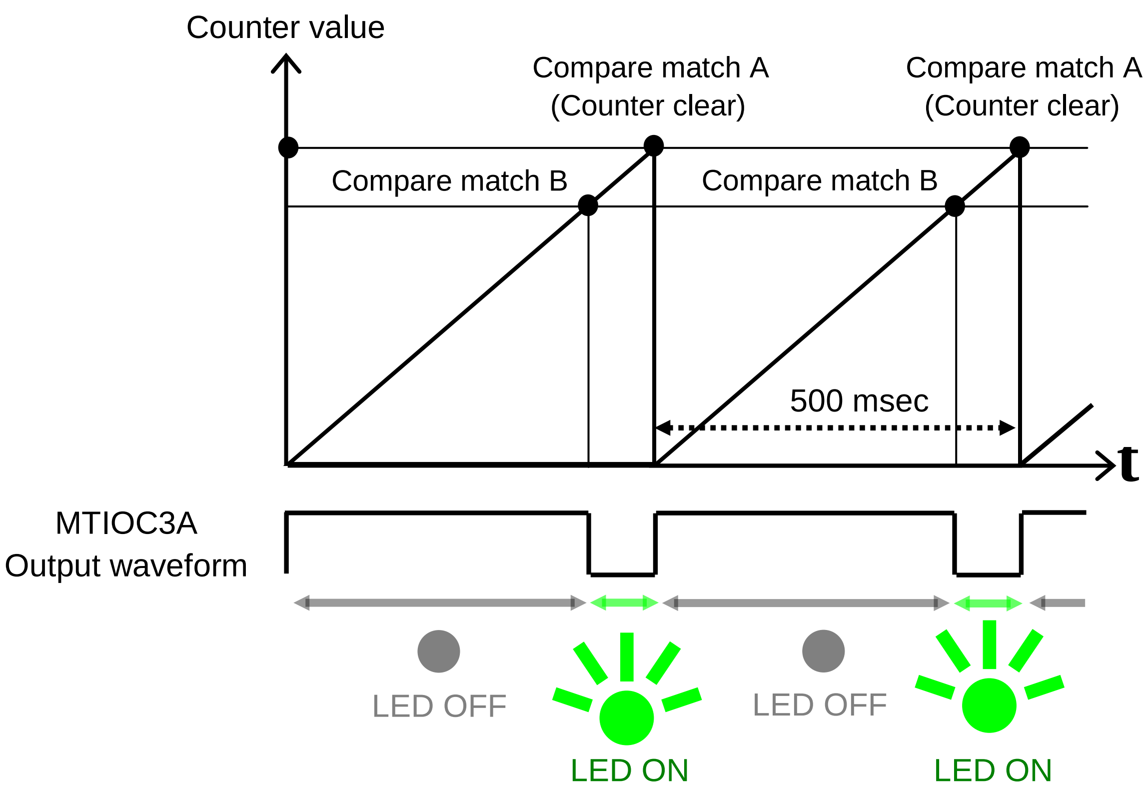
Note : If there is a switch that enables/disables P14(MTIOC3A) on the RSK board, enable it.

The LED0 turns on when the output from P14 is 0, and turns off when the output is 1.



The MTU2a channel 3 (MTU3) will be operated in PWM mode 1. In PWM mode 1, the output signal is controlled by compare match A and B.

Operation of the timer to be set
- Output 0 at compare match B -> LED turns on
- Output 1 at compare match A -> LED turns off
- Clear the counter at compare match A (Intervals of 500 msec)



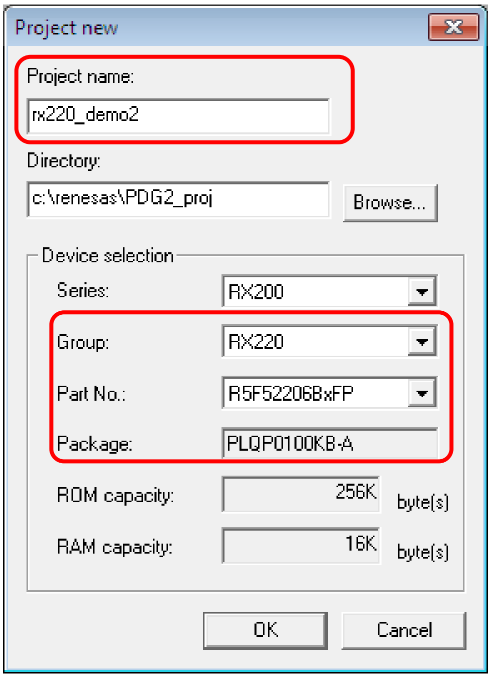
PDG

(1) Making the Peripheral Driver Generator project

Make the new Peripheral Driver Generator project "rx220_demo2". For details on how to make the new Peripheral Driver Generator project, refer to section 4.1 (1), Making the Peripheral Driver Generator project. Set the CPU type as follows.

Series : RX200
Group : RX220
Part No. : R5F52206BxFP

Note: If another type of chip is mounted on your RSK board, select corresponding CPU type.



(2) Clock setting PDG

1. The clock setting window opens and the error icons are displayed in the initial state. For icons such as  and  displayed on window, refer to section 4.1 (2), Initial state.
2. For the clock setting, refer to section 4.1 (3), Clock setting.

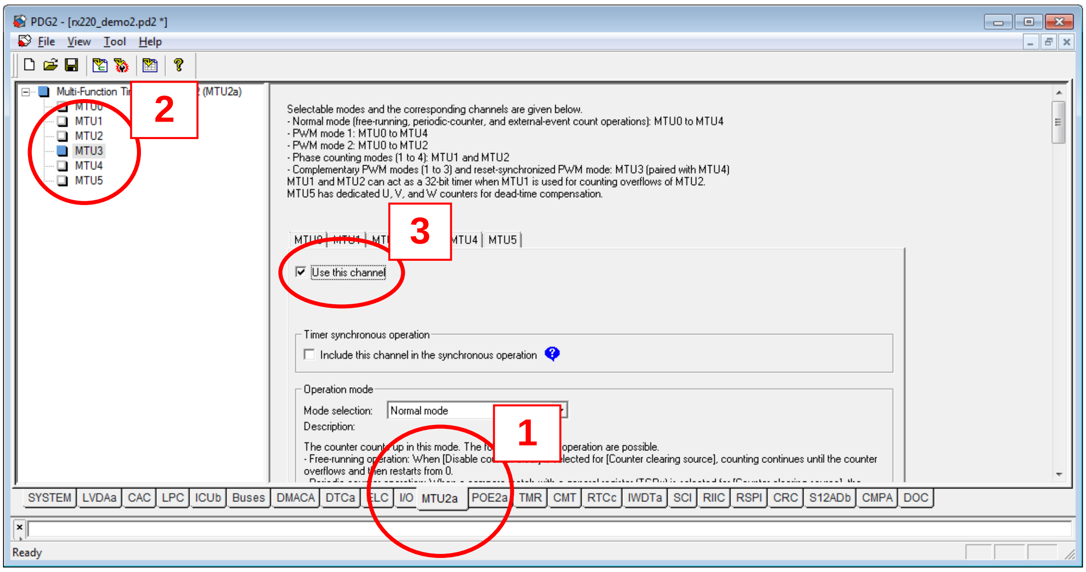
(3) Endian setting PDG

For the endian setting, refer to section 3.3, Endian.

(4) MTU2a setting-1 **PDG**

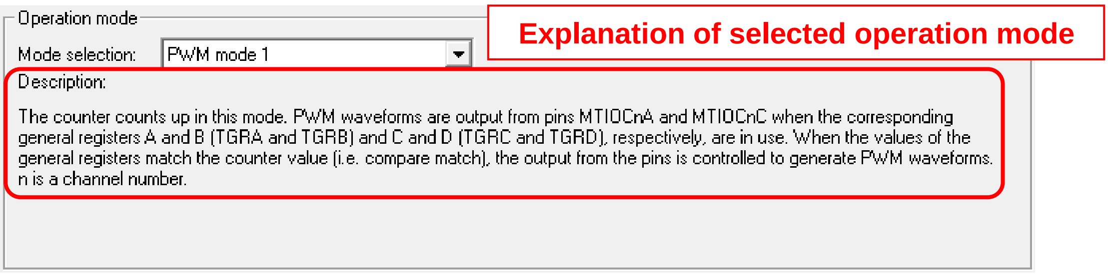
Opening MTU2a channel 3(MTU3) setting window

1. Select "MTU2a" tab.
2. Select "MTU3" on tree view.
3. Check “Use this channel”.



(5) MTU2a setting-2 **PDG**

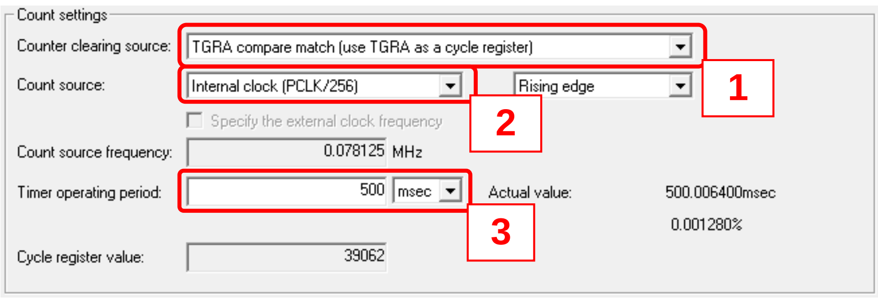
Select “PWM mode 1” for the operation mode.



(6) MTU2a setting-3 **PDG**

The counter setting is as follows.

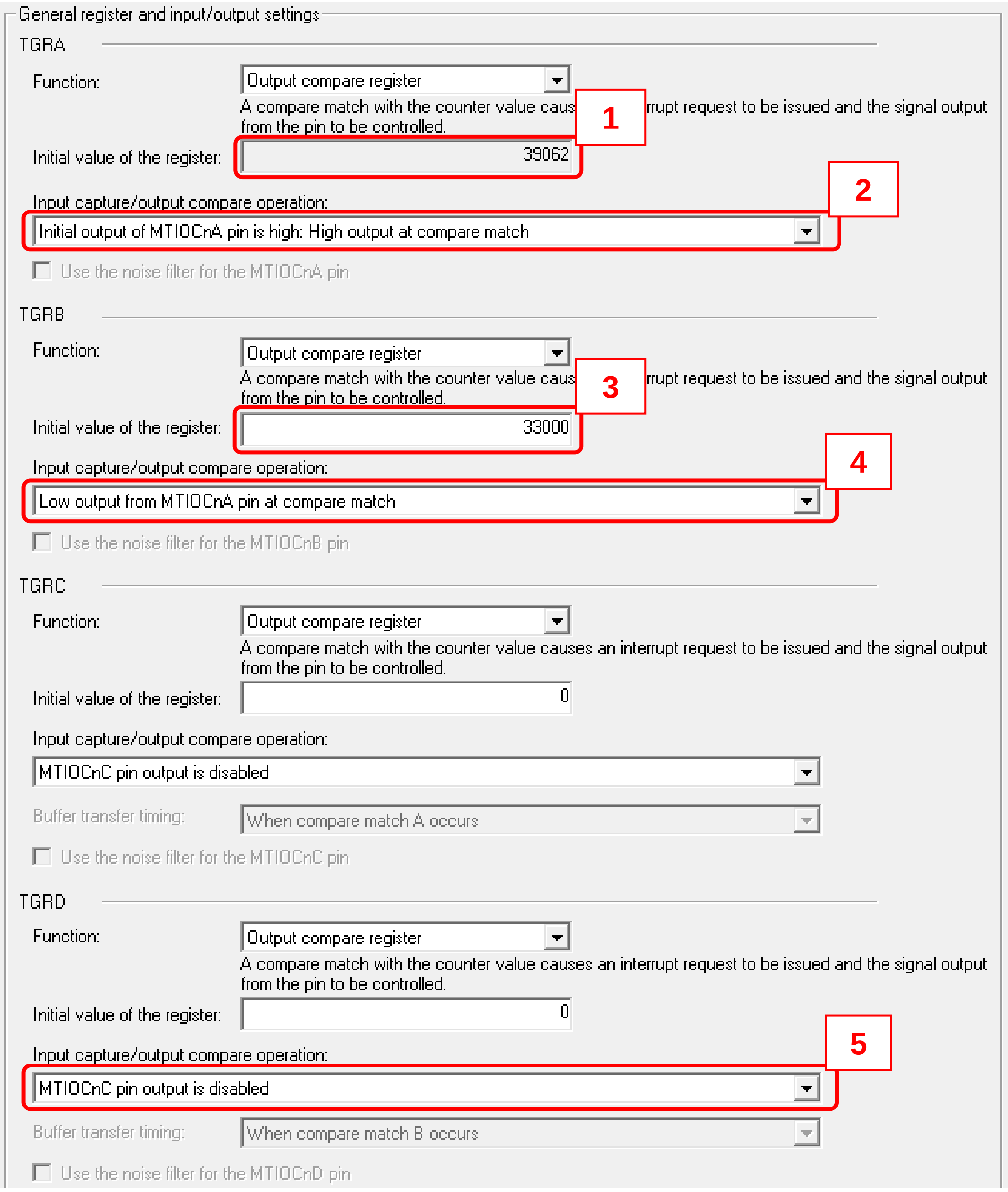
1. Select "TGRA register compare match" for a counter clearing source.
2. Select "Internal clock (PCLK/256)” for a count source.
3. Set “500msec” to timer operation period.



(7) MTU2a setting-4 PDG

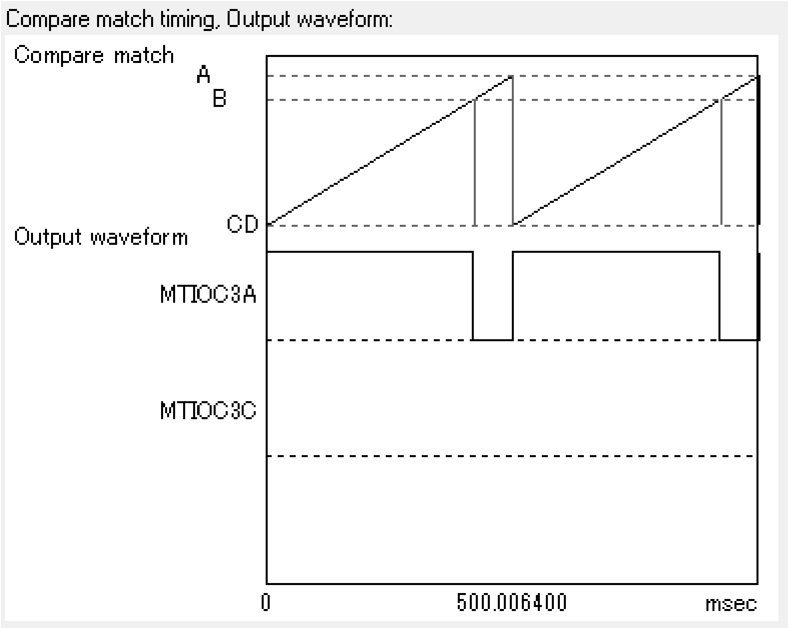
General register setting is as follows.

1. The TGRA is selected as a counter clearing source in the counter setting. Then the TGRA value is calculated from the count source frequency and the timer operating period.
2. Select "Initial output of MTIOCnA pin is high: High output at compare match" for TGRA output compare operation.
3. Set "33000" to TGRB initial value.
4. Select "Low output from MTIOCnA pin at compare match" for TGRB output compare operation.
5. The MTIOCnC output is not used in this tutorial. Select "MTIOCnC pin output is disabled" for TGRD output compare operation.



(8) MTU2a setting-5 **PDG**

The compare match timing and the output waveform are displayed in a diagram.



(9) Generating source files **PDG**

To generate source files, click  on the tool bar. For details on generating source files, refer to section 4.1 (9), Generating source files.

(10) Preparing the High-performance Embedded Workshop project **HEW**

Start the High-performance Embedded Workshop and make RX220 workspace. For details on making High-performance Embedded Workshop project, refer to section 4.1 (10), Preparing the High-performance Embedded Workshop project.

(11) Adding the generated source files to the High-performance Embedded Workshop project **PDG**

To add the generated source files to High-performance Embedded Workshop, click  on the tool bar. For details on adding the source files to High-performance Embedded Workshop project, refer to section 4.1 (11), Adding the generated source files to the High-performance Embedded Workshop project.

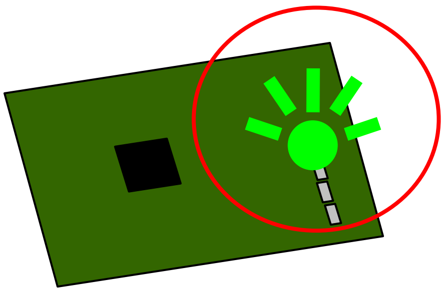
(12) Making the program on High-performance Embedded Workshop **HEW**

By changing the part of "main" function, make the following program on High-performance Embedded Workshop.

```
//Include "R_PG_<project name>.h"
#include "R_PG_rx220_demo2.h"

void main(void)
{
    //Configure I/O port pins that are not available
//  R_PG_IO_PORT_SetPortNotAvailable();

    //Set up the clock
    R_PG_Clock_Set();

    //Set up MTU2a Channel 3
    R_PG_Timer_Set_MTU_U0_C3();

    //Start the count of MTU2a Channel 3
    R_PG_Timer_StartCount_MTU_U0_C3();

    while(1);
}
```

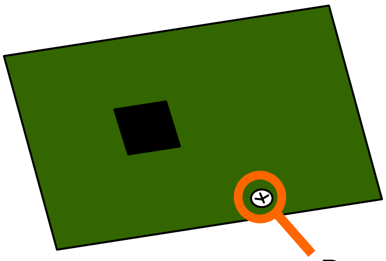
(13) Connecting to the emulator, building the program and executing **HEW**

Execute the program and see the LED blinking on RSK board. For details on connecting to the emulator, building the program, and executing the program, refer to section 4.1 (13), connecting to the emulator, building the program and executing.



4.3 Continuously scanning on 12-Bit A/D converter (S12ADb)

In RX220 RSK board, the potentiometer is connected to AN000 analog input. In this tutorial, the 12-Bit A/D converter (S12ADb) will be set up to execute A/D conversion continuously. And the result of A/D conversion will be monitored on High-performance Embedded Workshop.



Note : If there is a switch that enables/disables AN000 on the RSK board, enable it.

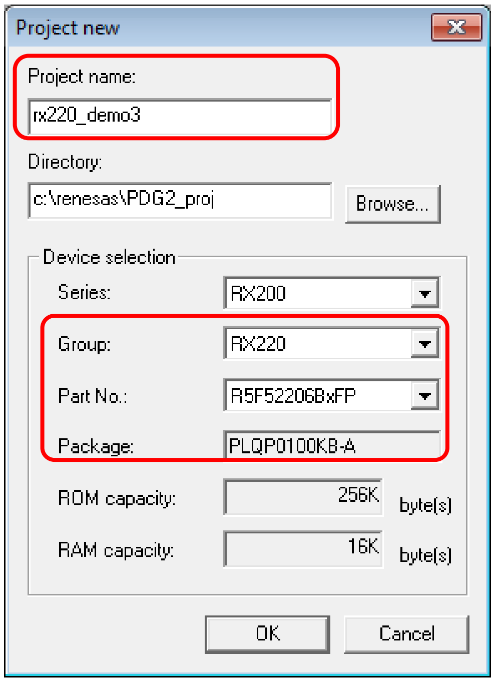
PDG

(1) Making the Peripheral Driver Generator project

Make the new Peripheral Driver Generator project “rx220_demo3”. For details on how to make the new Peripheral Driver Generator project, refer to section 4.1 (1), Making the Peripheral Driver Generator project. Set the CPU type as follows.

Series : RX200
Group : RX220
Part No. : R5F52206BxFP

Note: If another type of chip is mounted on your RSK board, select corresponding CPU type.



(2) Clock setting **PDG**

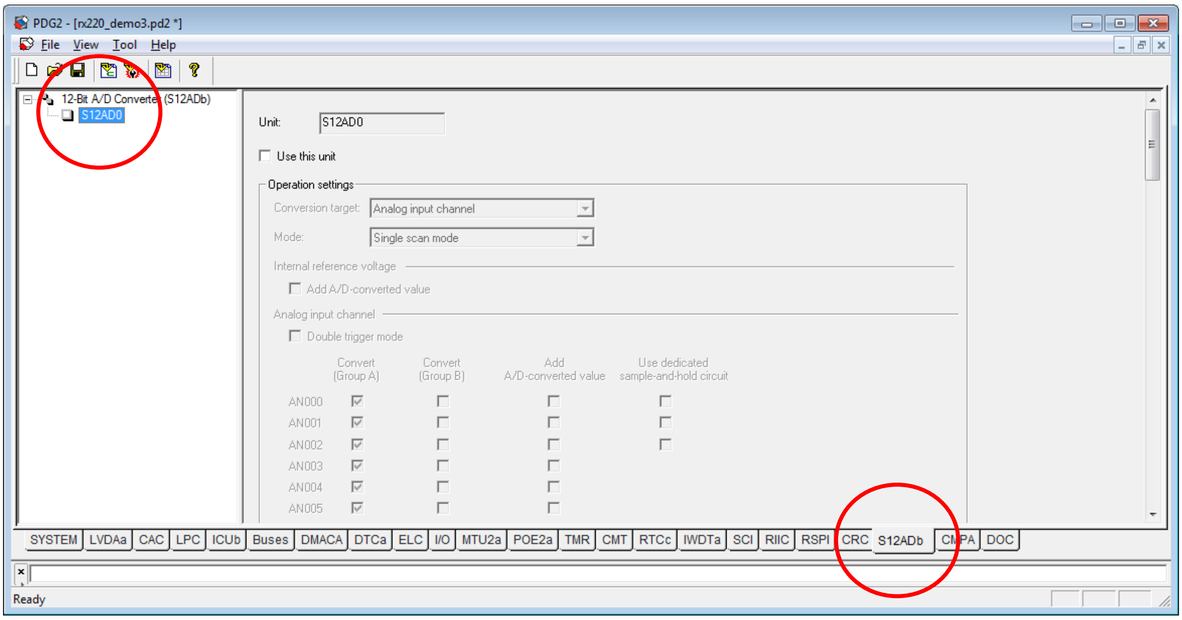
1. The clock setting window opens and the error icons are displayed in the initial state. For icons such as and displayed on window, refer to section 4.1 (2), Initial state.
2. For the clock setting, refer to section 4.1 (3), Clock setting.

(3) Endian setting **PDG**

For the endian setting, refer to section 3.3, Endian.

(4) A/D converter setting-1 **PDG**

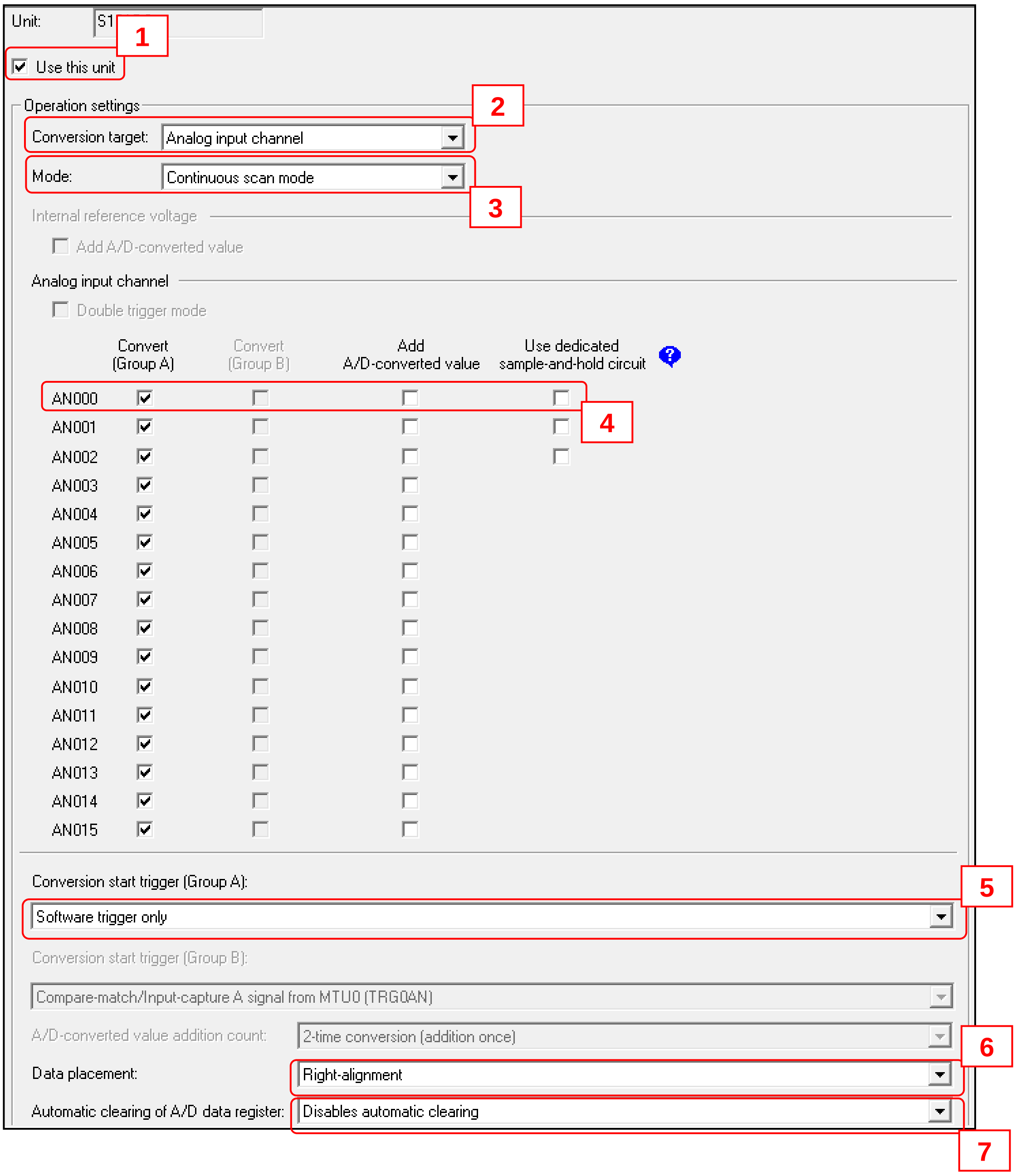
Select “S12ADb” tab and click S12AD0 on tree view.



(5) A/D converter setting-2 PDG

Make the following setting for S12AD0.

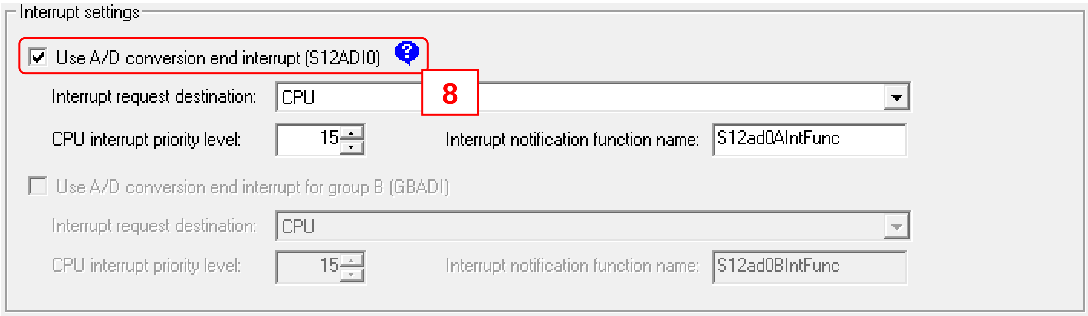
1. Check "Use this unit".
2. Select "Analog input channel" for the conversion target.
3. Select "Continuous scan mode" for the operation mode.
4. Check "AN000" for the analog input channel.
5. Select "Software trigger only" for the conversion start trigger (Group A).
6. Select "Right-alignment" for the data placement.
7. Select "Disables automatic clearing" for the automatic clearing of A/D data register.



(6) A/D converter setting-3 PDG

Make the following setting for S12AD0.

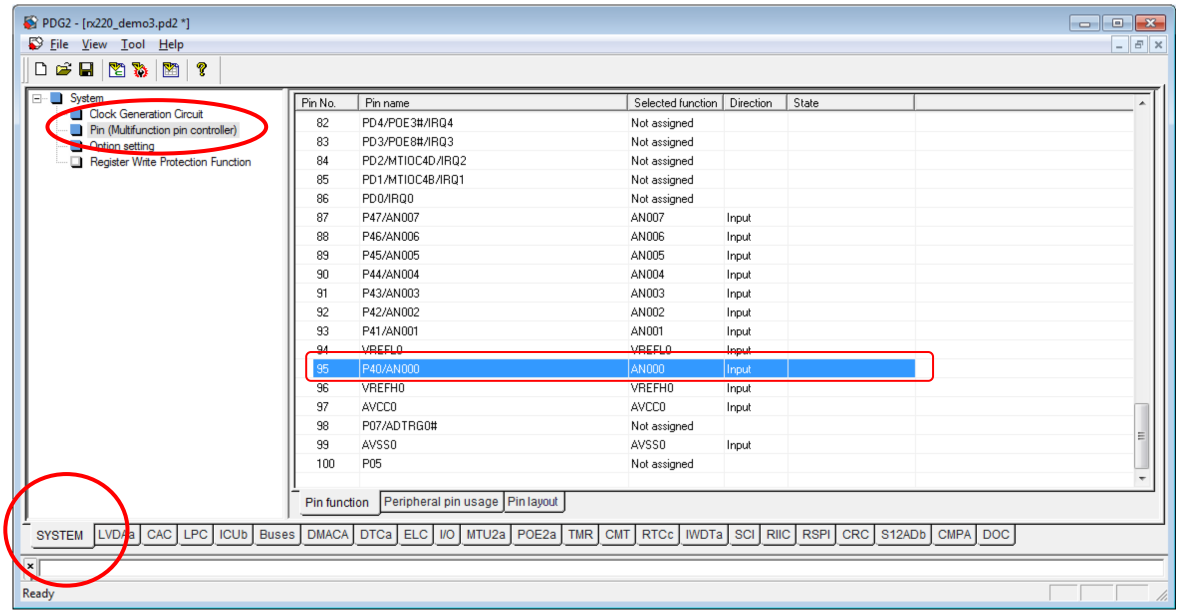
8. Check "Use A/D conversion end interrupt (S12ADI0)".



(7) Checking the pin usage PDG

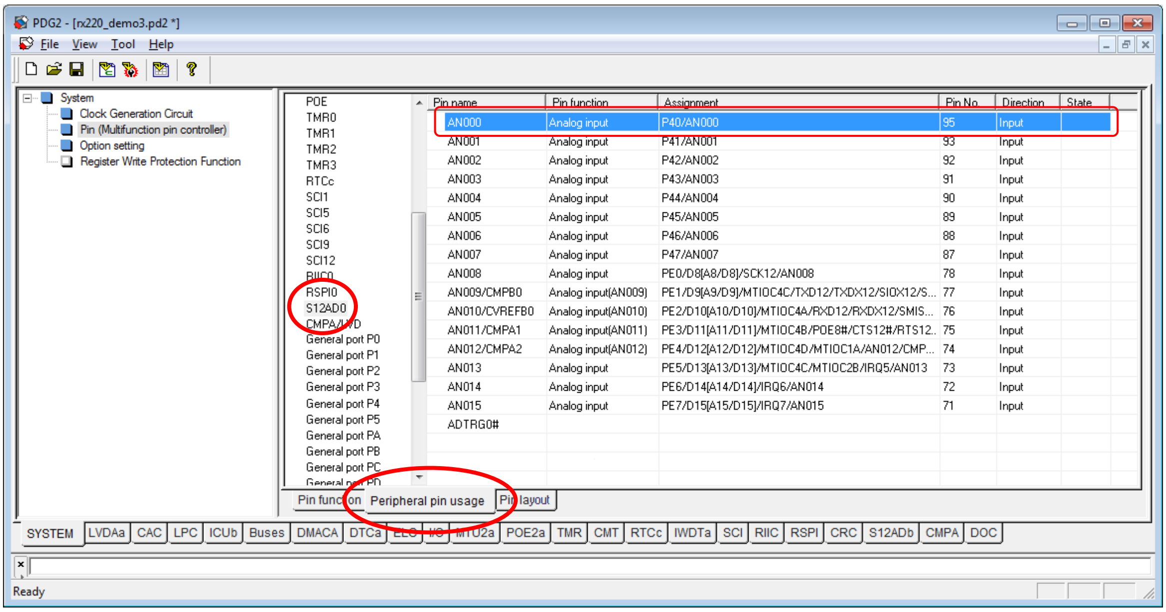
- It is possible to check the usage of pins on the pin function windows

1. After setting up the S12ADb, select “SYSTEM” tab and click “Pin (Multifunction pin controller)” on the tree view.
2. On the Pin function window, you can see that No.95 pin is used as AN000.



- State of pin usage for each peripheral module is displayed in the peripheral pin usage window.

Select peripheral pin usage sheet and click S12AD0 to check the usage of AN000 pin.



(8) Generating source files **PDG**

To generate source files, click  on the tool bar. For details on generating source files, refer to section 4.1 (9), Generating source files.

(9) Preparing the High-performance Embedded Workshop project **HEW**

Start the High-performance Embedded Workshop and make RX220 workspace. For details on making High-performance Embedded Workshop project, refer to section 4.1 (10), Preparing the High-performance Embedded Workshop project.

PDG

(10) Adding the generated source files to the High-performance Embedded Workshop project

To add the generated source files to High-performance Embedded Workshop, click  on the tool bar. For details on adding the source files to High-performance Embedded Workshop project, refer to section 4.1 (11), Adding the generated source files to the High-performance Embedded Workshop project.

(11) Making the program on High-performance Embedded Workshop **HEW**

By changing the part of “main” function, make the following program on High-performance Embedded Workshop.

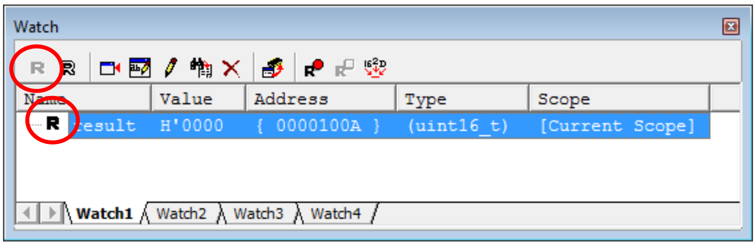
```
//Include "R_PG_<project name>.h"
#include "R_PG_rx220_demo3.h"

void main(void)
{
	//Configure I/O port pins that are not available
//	R_PG_IO_PORT_SetPortNotAvailable();

	//Set up the clock
	R_PG_Clock_Set();

	//Set up A/D converter
	R_PG_ADC_12_Set_S12AD0();

	//Start A/D conversion
	R_PG_ADC_12_StartConversionSW_S12AD0();

	while(1);
}

//Variable to store the result
uint16_t result;

//A/D conversion end interrupt notification function
void S12ad0AIntFunc(void)
{
	//Get the result of conversion
	R_PG_ADC_12_GetResult_S12AD0(&result);
}
```

(12) Connecting to the emulator, building the program and downloading **HEW**

Build the program and download it. For details on connecting to the emulator, building the program, and downloading refer to section 4.1 (13), connecting to the emulator, building the program and executing.

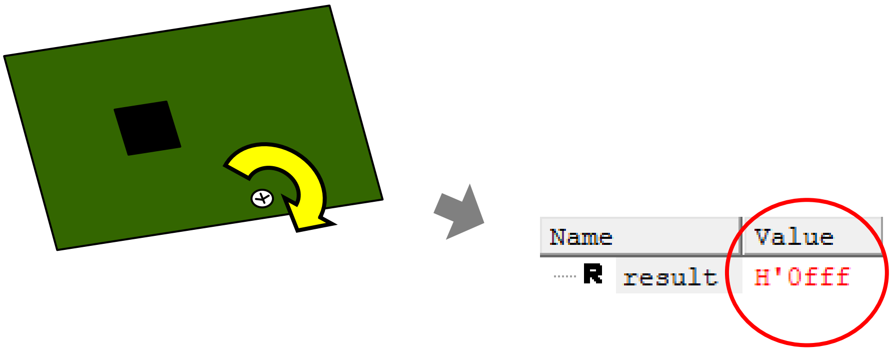
(13) Adding the variable of A/D conversion result to the watch window **HEW**

Open the Watch window and add the variable "result". Set "result" to the real time update to monitor the variable change during execution.



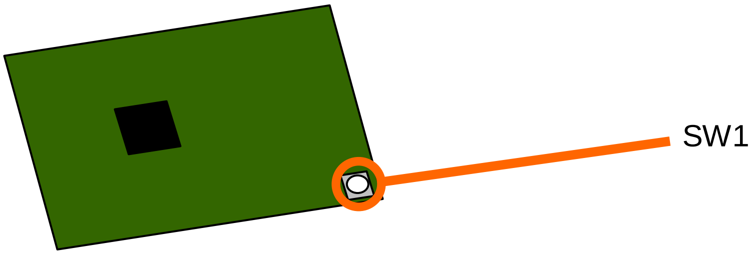
(14) Executing the program and monitoring the A/D conversion result **HEW**

Start the execution and screw the potentiometer to change the analog input voltage. The value of “result” on the watch window will change.



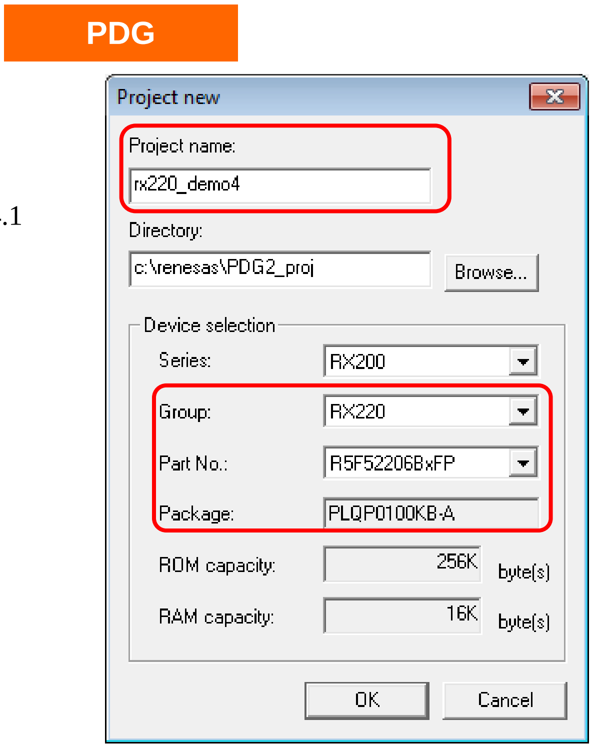
4.4 Triggering DTCa by ICUb

In RX220 RSK board, switch 1 (SW1) is connected to IRQ1. In this tutorial, the data transfer controller (DTCa) and ICUb will be set up and DTC transfer triggered by IRQ1 will be performed.



Note : If there is a switch that enables/disables IRQ1 on the RSK board, enable it.

(1) Making the Peripheral Driver Generator project



Make the new Peripheral Driver Generator project "rx220_demo4". For details on how to make the new Peripheral Driver Generator project, refer to section 4.1 (1), Making the Peripheral Driver Generator project. Set the CPU type as follows.

Series : RX200
Group : RX220
Part No. : R5F52206BxFP

Note: If another type of chip is mounted on your RSK board, select corresponding CPU type.

(2) Clock setting **PDG**

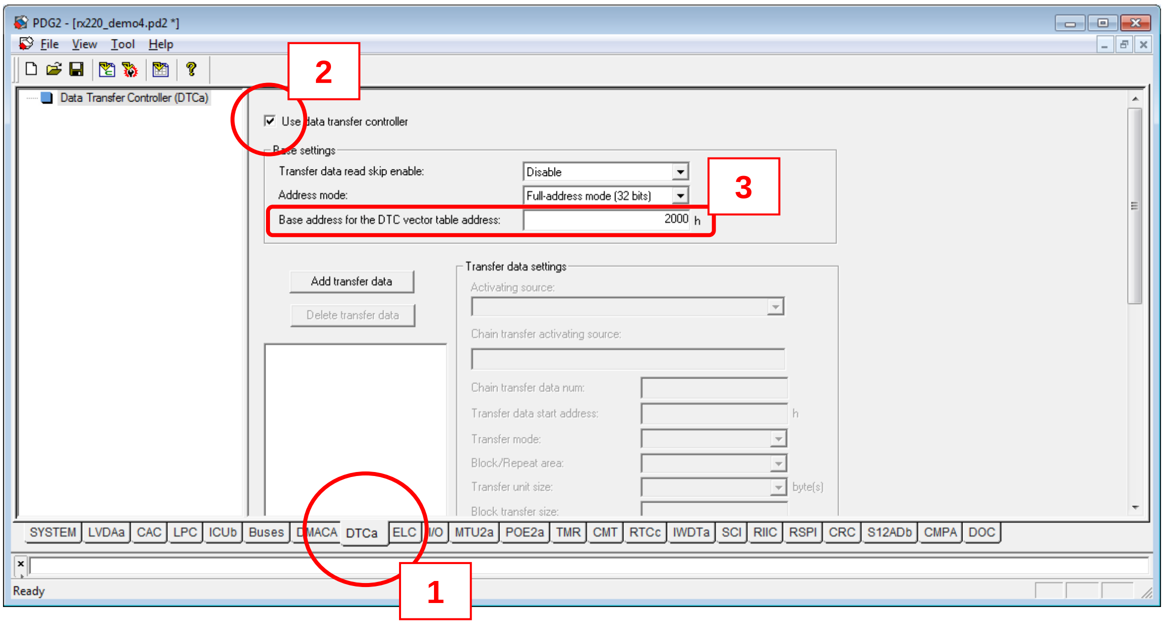
1. The clock setting window opens and the error icons are displayed in the initial state. For icons such as and displayed on window, refer to section 4.1 (2), Initial state.
2. For the clock setting, refer to section 4.1 (3), Clock setting.

(3) Endian setting **PDG**

For the endian setting, refer to section 3.3, Endian.

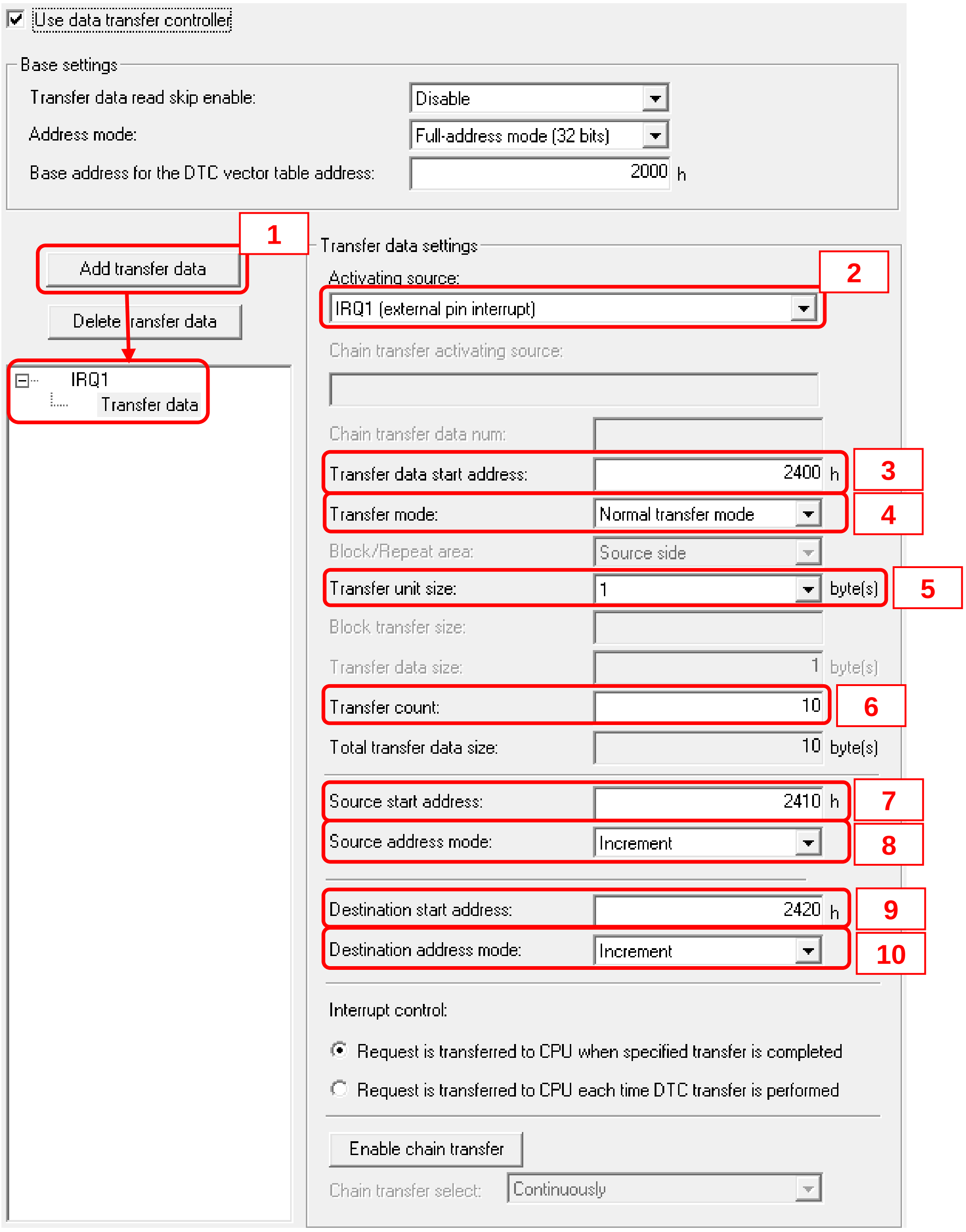
(4) DTCa setting-1 **PDG**

1. Select “DTCa” tab to open the DTCa setting window.
2. Check "Use data transfer controller".
3. The DTCa vector table will be allocated from 2000h. Set “2000”.



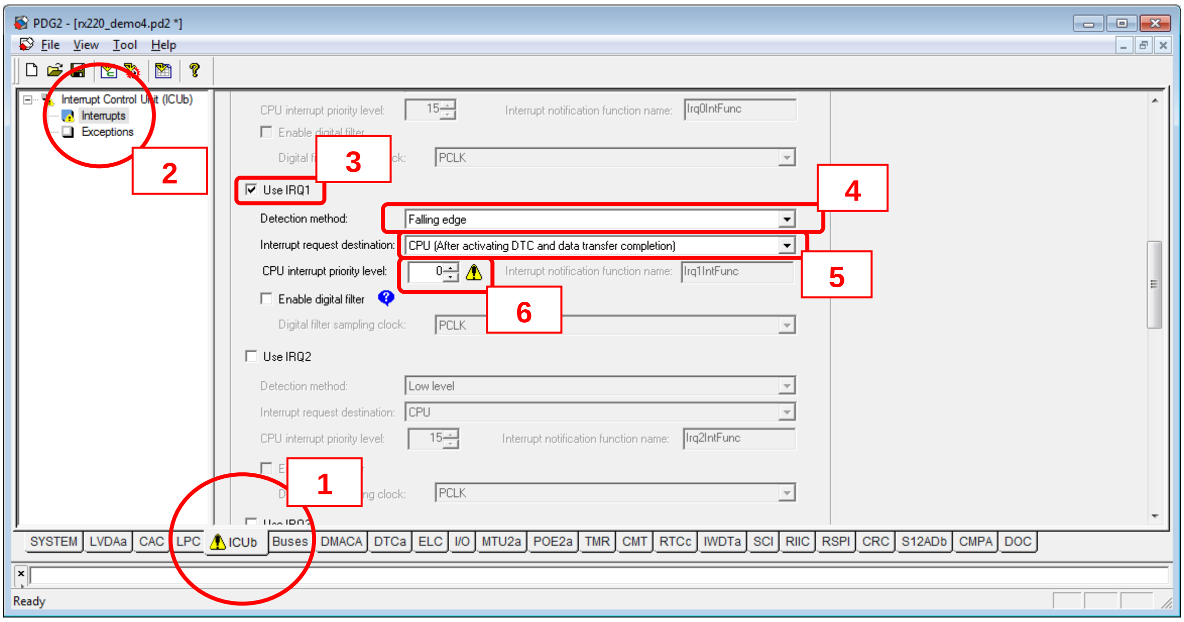
(5) DTCa setting-2 **PDG**

1. Click [Add transfer data] to add the transfer data.
2. Select "IRQ1 (external pin interrupt)" for the activating source.
3. Set "2400" to the transfer data start address.
4. Select "Normal transfer mode" for the transfer mode.
5. Set "1" to the transfer unit size.
6. Set "10" to the transfer count.
7. Set "2410" to the source start address.
8. Select "Increment" for the source address mode.
9. Set "2420" to the destination start address.
10. Select "Increment" for the destination address mode.



(6) ICUb setting **PDG**

1. Select “ICUb” tab to open the ICUb setting window.
2. Click “Interrupts” on the tree view.
3. Check "Use IRQ1".
4. Select “Falling edge” for the detection method of IRQ1.
5. Select “CPU (After activating DTC and data transfer completion)”.
6. CPU interrupt will not be used then set “0” to the CPU interrupt priority level.



(7) Generating source files **PDG**

To generate source files, click  on the tool bar. For details on generating source files, refer to section 4.1 (9), Generating source files.

(8) Preparing the High-performance Embedded Workshop project **HEW**

Start the High-performance Embedded Workshop and make RX220 workspace. For details on making High-performance Embedded Workshop project, refer to section 4.1 (10), Preparing the High-performance Embedded Workshop project.

PDG

(9) Adding the generated source files to the High-performance Embedded Workshop project

To add the generated source files to High-performance Embedded Workshop, click  on the tool bar. For details on adding the source files to High-performance Embedded Workshop project, refer to section 4.1 (11), Adding the generated source files to the High-performance Embedded Workshop project.

(10) Making the program on High-performance Embedded Workshop **HEW**

By changing the part of “main” function, make the following program on High-performance Embedded Workshop.

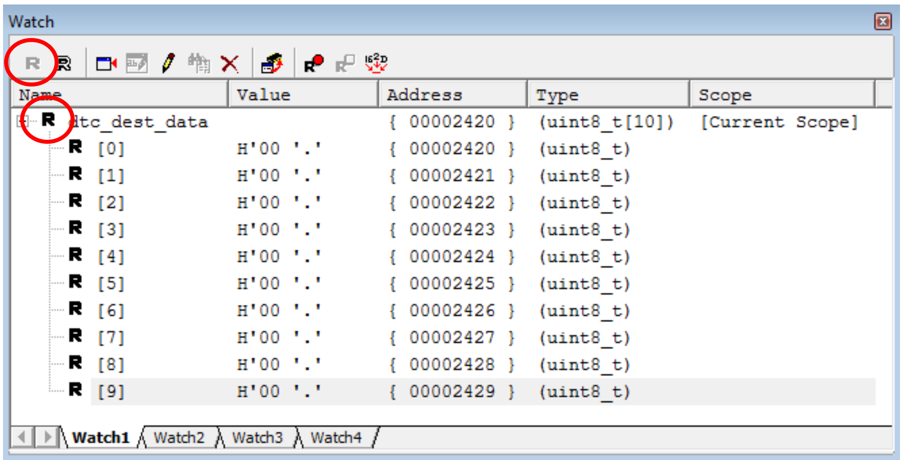
```
//Include "R_PG_<project name>.h"
#include "R_PG_rx220_demo4.h"

//DTC vector table
#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];

//DTC transfer data storage area (IRQ1)
#pragma address dtc_transfer_data_IRQ1 = 0x00002400
uint32_t dtc_transfer_data_IRQ1 [4];

//Transfer source
#pragma address dtc_src_data = 0x00002410
uint8_t dtc_src_data [10] = "ABCDEFGHIJ";

//Transfer destination
#pragma address dtc_dest_data = 0x00002420
uint8_t dtc_dest_data [10];

void main(void)
{
	//initialize transfer destination
	int i;
	for(i=0; i<10; i++ ){
		dtc_dest_data[i] = 0;
	}

	//Configure I/O port pins that are not available
//	R_PG_IO_PORT_SetPortNotAvailable();

	R_PG_Clock_Set();	// Set up the clock

	// Set up the DTC (e.g. vector table address)
	R_PG_DTC_Set();

	// Set up the DTC (transfer data of IRQ1)
	R_PG_DTC_Set_IRQ1();

	R_PG_ExtInterrupt_Set_IRQ1();	// Set up IRQ1

	R_PG_DTC_Activate();	// Make the DTC be ready to the trigger
	while(1);
}
```

(11) Connecting to the emulator, building the program and downloading **HEW**

Build the program and download it. For details on connecting to the emulator, building the program, and downloading refer to section 4.1 (13), connecting to the emulator, building the program and executing.

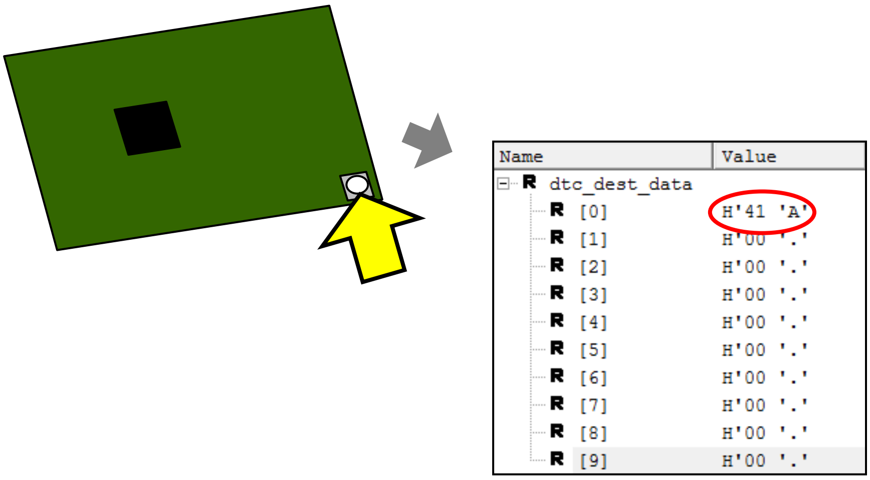
(12) Adding the variable of the transfer destination **HEW**

Open the Watch window and add the variable "dtc_dest_data". Expand the array and set it to the real time update to monitor the variable change during execution.



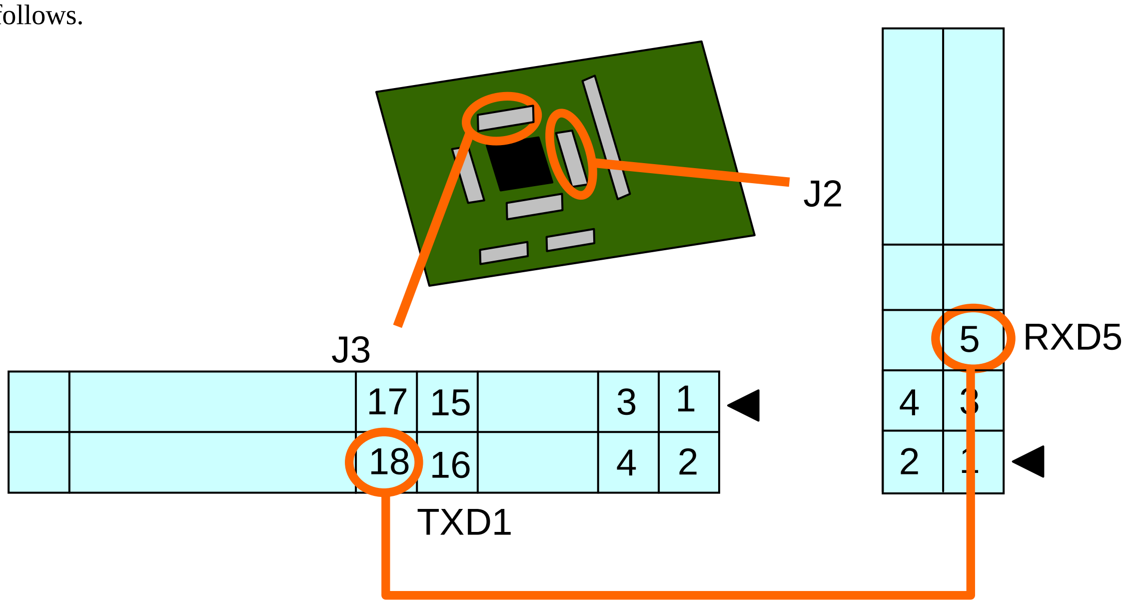
(13) Executing the program and monitoring the result of the transfer **HEW**

Start the execution and push the SW1. The value of “dtc_dest_data” on the watch window will change.



4.5 Data transfer between SCIe channels 1 and 5

In this tutorial, SCI channel 1 and 5 will be set up to transfer data in asynchronous mode. Connect the transmission pin of channel 1 (TXD1) and the reception pin of channel 5 (RXD5) on the RSK board as follows.



Note : If there are switches that enables/disables TXD1 and RXD5 on the RSK board, enable it.

PDG

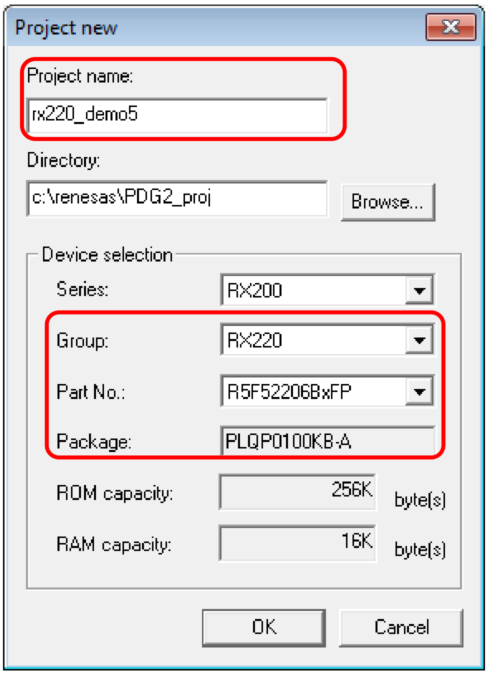
(1) Making the Peripheral Driver Generator project

Make the new Peripheral Driver Generator project “rx220_demo5”. For details on how to make the new Peripheral Driver Generator project, refer to section 4.1 (1), Making the Peripheral Driver Generator project.

Set the CPU type as follows.

Series : RX200
Group : RX220
Part No. : R5F52206BxFP

Note: If another type of chip is mounted on your RSK board, select corresponding CPU type.



(2) Clock setting **PDG**

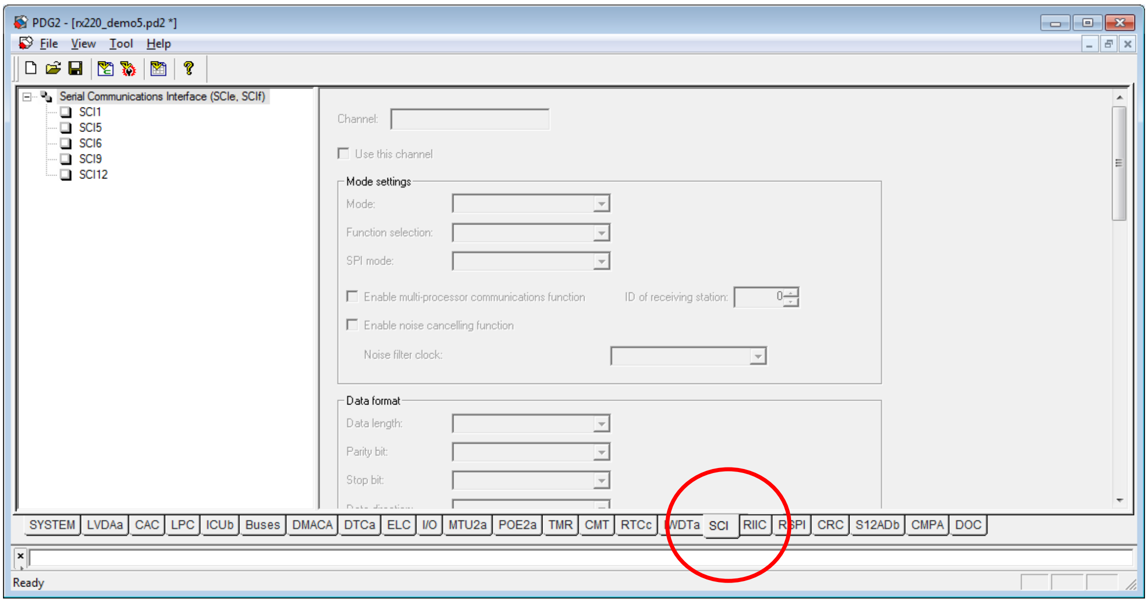
1. The clock setting window opens and the error icons are displayed in the initial state. For icons such as and displayed on window, refer to section 4.1 (2), Initial state.
2. For the clock setting, refer to section 4.1 (3), Clock setting.

(3) Endian setting **PDG**

For the endian setting, refer to section 3.3, Endian.

(4) SCIe setting **PDG**

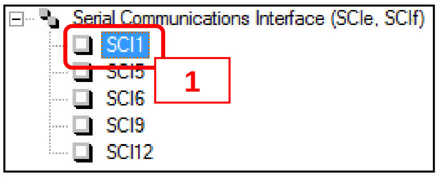
Select “SCI” tab to open the SCIe setting window.



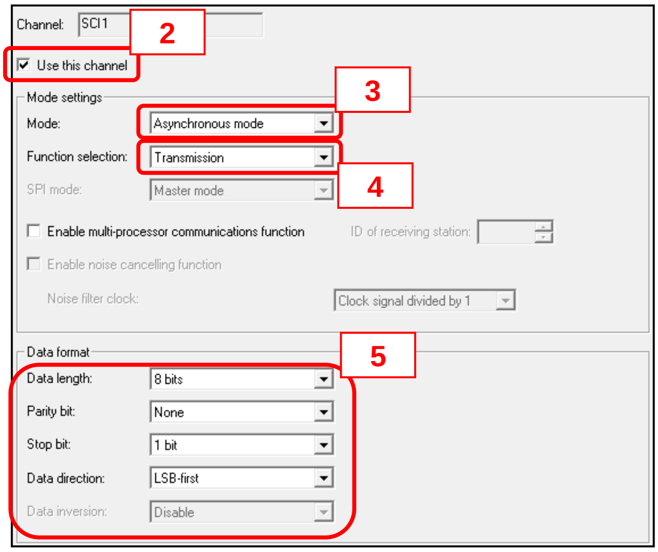
(5) SCI1 (transmitter) setting **PDG**

Make the setting for SCI1 as follows.

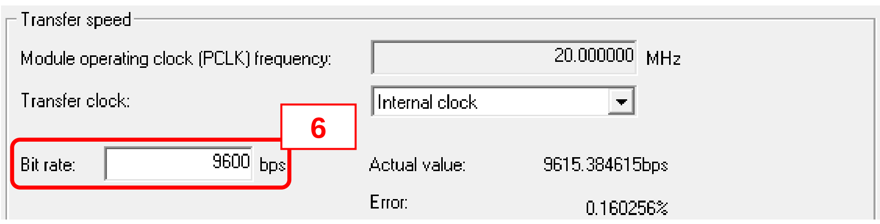
1. Select SCI1 on the tree view.



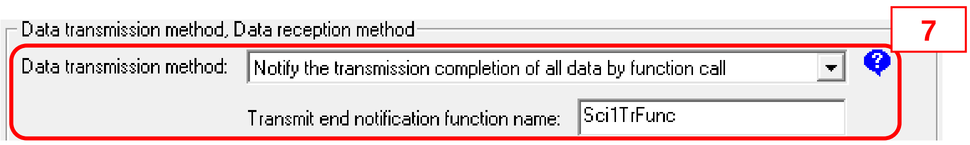
2. Check “Use this channel”.
3. Select “Asynchronous mode”.
4. Select “Transmission” for the function.
5. Leave the data format settings at the default.



6. Set the bit rate to “9600bps”.



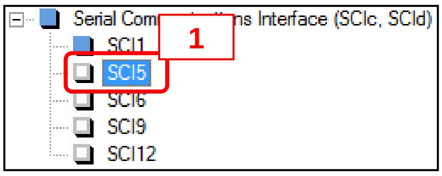
7. Select “Notify the transmission completion of all data by function call” for the data transmission method.



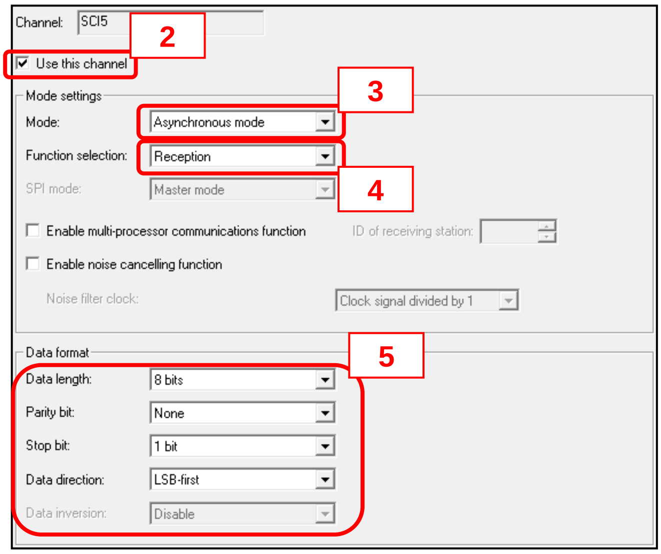
(6) SCI5 (receptor) setting **PDG**

Make the setting for SCI5 as follows.

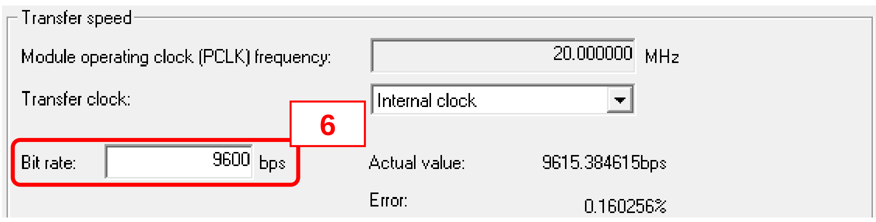
1. Select SCI5 on the tree view.



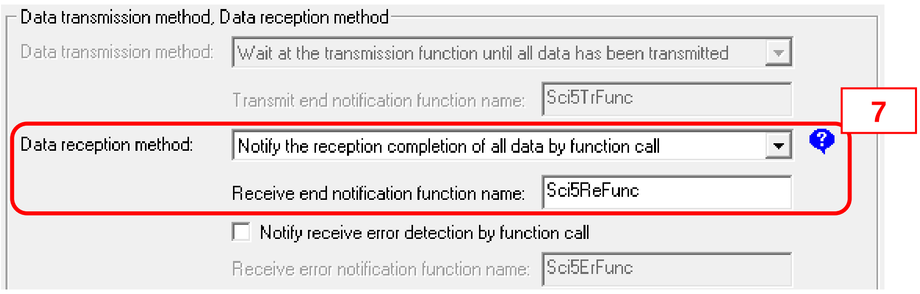
2. Check “Use this channel”.
3. Select “Asynchronous mode”.
4. Select “Reception” for the function.
5. Leave the data format settings at the default.



6. Set the bit rate to “9600bps”.



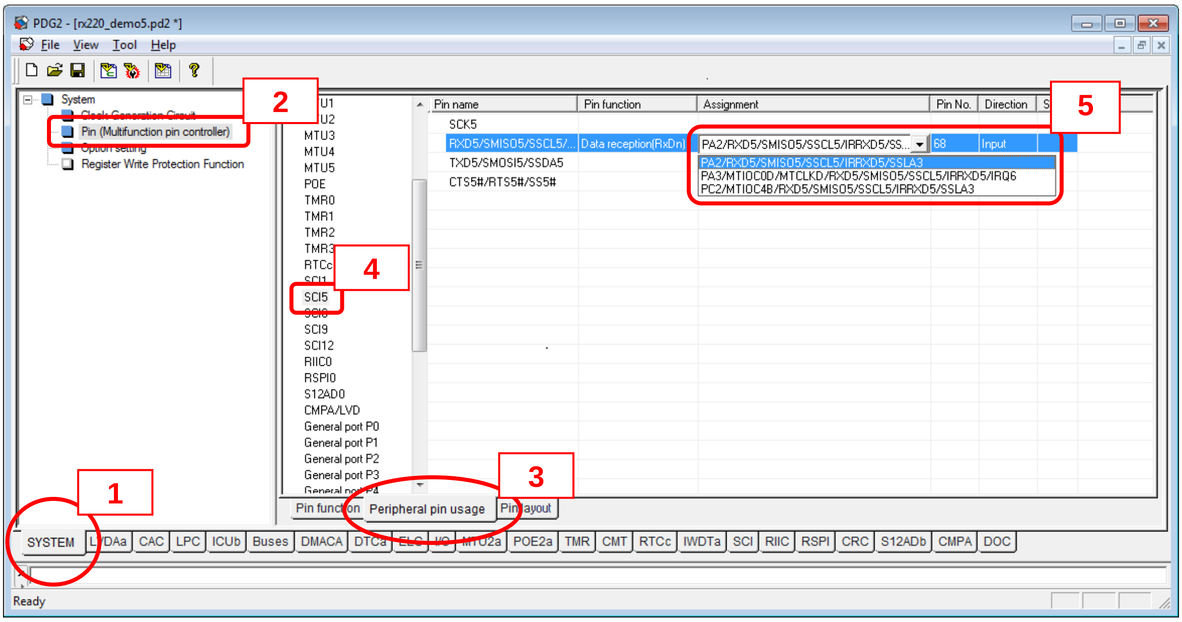
7. Select “Notify the reception completion of all data by function call” for the data reception method.



(7) Pin setting **PDG**

The RXD5 can be assigned to RXD5 (PA2) or RXD5 (PA3) or RXD5 (PC2). Select the pin function assignment as follows.

1. Select “SYSTEM” tab.
2. Select “Pin (Multifunction pin controller)” on tree view.
3. Select “Peripheral pin usage” tab.
4. Select “SCI5” from the peripheral module list.
5. When the mouse pointer is placed on “Assignment” column of RXD5 line, a dropdown button is displayed. Select “PA2/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3” from the dropdown list.



(8) Generating source files **PDG**

To generate source files, click  on the tool bar. For details on generating source files, refer to section 4.1 (9), Generating source files.

(9) Preparing the High-performance Embedded Workshop project **HEW**

Start the High-performance Embedded Workshop and make RX220 workspace. For details on making High-performance Embedded Workshop project, refer to section 4.1 (10), Preparing the High-performance Embedded Workshop project.

PDG

(10) Adding the generated source files to the High-performance Embedded Workshop project

To add the generated source files to High-performance Embedded Workshop, click  on the tool bar. For details on adding the source files to High-performance Embedded Workshop project, refer to section 4.1 (11), Adding the generated source files to the High-performance Embedded Workshop project.

(11) Making the program on High-performance Embedded Workshop **HEW**

By changing the part of “main” function, make the following program on High-performance Embedded Workshop.

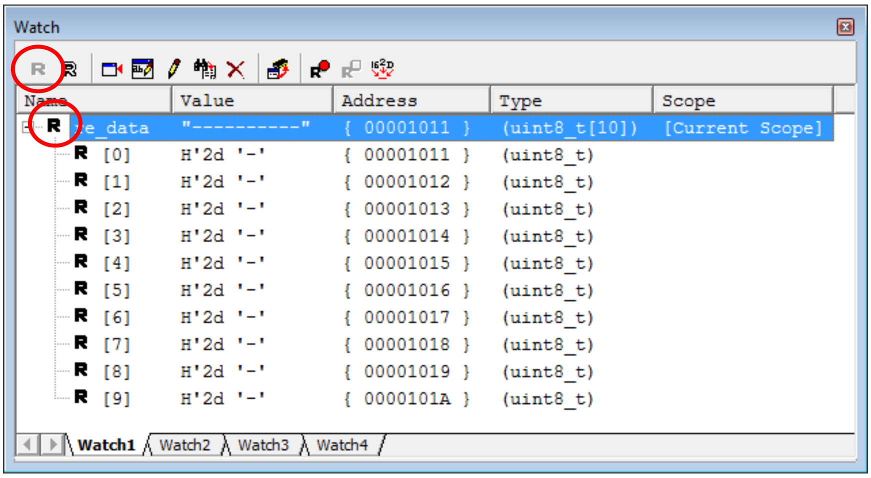
```
//Include "R_PG_<project name>.h"
#include "R_PG_rx220_demo5.h"

//SCI1 transmission data
uint8_t tr_data[10] = "ABCDEFGHIJ";

//SCI5 reception data storage area
uint8_t re_data[10] = "----------";

void main(void)
{
	//Configure I/O port pins that are not available
//	R_PG_IO_PORT_SetPortNotAvailable();

	// Set up the clock
	R_PG_Clock_Set();

	// Set up the SCI1
	R_PG_SCI_Set_C1();

	// Set up the SCI5
	R_PG_SCI_Set_C5();

	// Start SCI5 reception (number of data : 10)
	R_PG_SCI_StartReceiving_C5( re_data, 10 );

	// Start SCI1 transmission (number of data : 10)
	R_PG_SCI_StartSending_C1( tr_data, 10 );

	while(1);
}

//SCI1 transmission end notification function
void Sci1TrFunc(void)
{
	//Stop SCI1 communication
	R_PG_SCI_StopCommunication_C1();
}

//SCI5 reception end notification function
void Sci5ReFunc(void)
{
	//Stop SCI5 communication
	R_PG_SCI_StopCommunication_C5();
}
```

(12) Connecting to the emulator, building the program and downloading HEW

Build the program and download it. For details on connecting to the emulator, building the program, and downloading refer to section 4.1 (13), connecting to the emulator, building the program and executing.

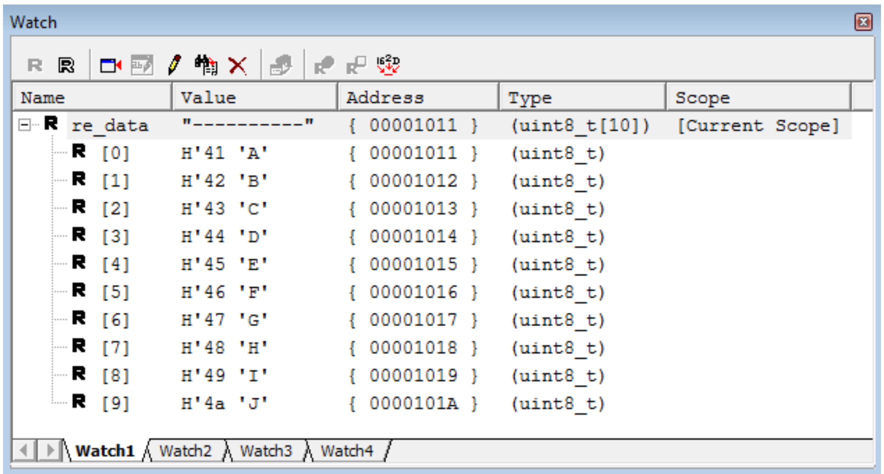
(13) Adding the variable of the reception data HEW

Open the Watch window and add the variable "re_data". Expand the array and set it to the real time update to monitor the variable change during execution.



(14) Executing the program and monitoring the result of the transfer HEW

Start the execution and check the value of “re_data” on the watch window.



5. Specification of Generated Functions

Table 5.1 shows generated functions for the RX220.

Table 5.1 Generated Functions for the RX220

Clock-generation circuit

Generated Function	Description
R_PG_Clock_Set	Set up the clocks
R_PG_Clock_WaitSet	Set up the clocks (wait cycle insertion)
R_PG_Clock_Start_MAIN	Start the main clock oscillator
R_PG_Clock_Stop_MAIN	Stop the main clock oscillator
R_PG_Clock_Start_SUB	Start the sub-clock oscillator
R_PG_Clock_Stop_SUB	Stop the sub-clock oscillator
R_PG_Clock_Start_LOCO	Start the low-speed on-chip oscillator (LOCO)
R_PG_Clock_Stop_LOCO	Stop the low-speed on-chip oscillator (LOCO)
R_PG_Clock_Start_HOCO	Start the high-speed on-chip oscillator (HOCO)
R_PG_Clock_Stop_HOCO	Stop the high-speed on-chip oscillator (HOCO)
R_PG_Clock_PowerON_HOCO	Turn on the high-speed on-chip oscillator (HOCO) power supply
R_PG_Clock_PowerON_HOCO	Turn off the high-speed on-chip oscillator (HOCO) power supply
R_PG_Clock_Enable_MAIN_StopDetection	Enable the main clock oscillation stop detection function
R_PG_Clock_Disable_MAIN_StopDetection	Disable the main clock oscillation stop detection function
R_PG_Clock_GetFlag_MAIN_StopDetection	Acquire the main clock oscillation stop detection flag
R_PG_Clock_ClearFlag_MAIN_StopDetection	Clear the main clock oscillation stop detection flag
R_PG_Clock_GetSelectedClockSource	Acquire the current internal clock source
R_PG_Clock_GetClocksStatus	Acquire the status of the clocks
R_PG_Clock_GetHOCOPowerStatus	Acquire the status of high-speed on-chip oscillator (HOCO) power supply

Voltage Detection Circuit (LVDAa)

Generated Function	Description
R_PG_LVD_Set	Set up the voltage detection circuit (Voltage-monitoring 1 and 2)
R_PG_LVD_GetStatus	Get the status flag of Voltage Detection Circuit
R_PG_LVD_ClearDetectionFlag_LVD<*Voltage Detection Circuit number*>	Clear Voltage Monitoring n Voltage Change Detection Flag n: 1 or 2
R_PG_LVD_Disable_LVD<*Voltage Detection Circuit number*>	Disable Voltage Monitoring n n: 1 or 2

Clock Frequency Accuracy Measurement Circuit (CAC)

Generated Function	Description
R_PG_CAC_Set	Set up the CAC and start the measurement
R_PG_CAC_ClearFlag_FrequencyError	Clear the frequency error flag
R_PG_CAC_ClearFlag_MeasurementEnd	Clear the measurement end flag
R_PG_CAC_ClearFlag_Overflow	Clear the overflow flag
R_PG_CAC_StartMeasurement	Start the measurement
R_PG_CAC_StopMeasurement	Stop the measurement
R_PG_CAC_GetStatusFlags	Acquire the CAC status flags
R_PG_CAC_GetCounterBufferRegister	Acquire the counter buffer register (CACNTBR) value
R_PG_CAC_StopModule	Shut down the CAC

Low Power Consumption

Generated Function	Description
R_PG_LPC_Set	Set up the low power consumption functions.
R_PG_LPC_Sleep	Enter sleep mode
R_PG_LPC_AllModuleClockStop	Enter all module clock stop mode
R_PG_LPC_SoftwareStandby	Enter software standby mode
R_PG_LPC_ChangeOperatingPowerControl	Change the operating power control mode
R_PG_LPC_ChangeSleepModeReturnClock	Change the sleep mode return clock source
R_PG_LPC_GetPowerOnResetFlag	Acquire the value of the power-on reset flag
R_PG_LPC_GetLVDDetectionFlag	Acquire the value of the LVD detection flags
R_PG_LPC_GetOperatingPowerControlFlag	Acquire the value of the operating power control mode transition flag
R_PG_LPC_GetStatus	Get the status of the low power consumption functions

Register Write Protection Function

Generated Function	Description
R_PG_RWP_RegisterWriteCgc	Enables or disables writing to registers associated with the clock generation circuit
R_PG_RWP_RegisterWriteModeLpcReset	Enables or disables writing to registers associated with the operating mode, low power comsumption, and software reset
R_PG_RWP_RegisterWriteLvd	Enables or disables writing to registers associated with LVD
R_PG_RWP_RegisterWriteMpc	Enables or disables writing to pin-function selection registers
R_PG_RWP_GetStatusCgc	Acquires a value indicating whether writing to registers associated with the clock generation circuit is enabled or disabled
R_PG_RWP_GetStatusModeLpcReset	Acquires a value indicating whether writing to registers associated with the operating

	mode, low power comsumption, and software reset is enabled or disabled
R_PG_RWP_GetStatusLvd	Acquires a value indicating whether writing to registers associated with LVD is enabled or disabled
R_PG_RWP_GetStatusMpc	Acquires a value indicating whether writing to pin-function selection registers is enabled or disabled

Interrupt controller (ICUb)

Generated Function	Description
R_PG_ExtInterrupt_Set_*<interrupt type>*	Set up an external interrupt
R_PG_ExtInterrupt_Disable_*<interrupt type>*	Disable the setting of an external interrupt
R_PG_ExtInterrupt_GetRequestFlag_*<interrupt type>*	Get an external interrupt request flag
R_PG_ExtInterrupt_ClearRequestFlag_*<interrupt type>*	Clear an external interrupt request flag
R_PG_ExtInterrupt_EnableFilter_*<interrupt type>*	Re-enable the digital filter
R_PG_ExtInterrupt_DisableFilter_*<interrupt type>*	Disable the digital filter
R_PG_SoftwareInterrupt_Set	Set up the software interrupt
R_PG_SoftwareInterrupt_Generate	Generate the software interrupt
R_PG_FastInterrupt_Set	Set an interrupt as the fast interrupt
R_PG_Exception_Set	Set exception handlers

Buses

Generated Function	Description
R_PG_ExtBus_PresetBus	Set the bus priority
R_PG_ExtBus_SetBus	Set the bus pins and the bus error monitoring
R_PG_ExtBus_GetErrorStatus	Acquire the status of bus error generation
R_PG_ExtBus_ClearErrorFlags	Clear the bus-error status registers

DMA controller (DMACA)

Generated Function	Description
R_PG_DMAC_Set_C*<channel number>*	Set up a DMAC channel
R_PG_DMAC_Activate_C*<channel number>*	Make the DMAC be ready for the start trigger
R_PG_DMAC_StartTransfer_C*<channel number>*	Start the one transfer of DMAC (Software trigger)
R_PG_DMAC_StartContinuousTransfer_C*<channel number>*	Start the continuous transfer of DMAC (Software trigger)
R_PG_DMAC_StopContinuousTransfer_C*<channel number>*	Stop the software-triggered continuous transfer of DMAC
R_PG_DMAC_Suspend_C*<channel number>*	Suspend the data transfer
R_PG_DMAC_GetTransferCount_C*<channel number>*	Get the transfer counter value
R_PG_DMAC_SetTransferCount_C*<channel number>*	Set the transfer counter
R_PG_DMAC_GetRepeatBlockSizeCount_C*<channel number>*	Get the repeat/block size counter value
R_PG_DMAC_SetRepeatBlockSizeCount_C*<channel number>*	Set the repeat/block size count
R_PG_DMAC_ClearInterruptFlag_C*<channel number>*	Get and clear the interrupt request flag
R_PG_DMAC_GetTransferEndFlag_C*<channel number>*	Get the transfer end flag
R_PG_DMAC_ClearTransferEndFlag_C*<channel number>*	Clear the transfer end flag
R_PG_DMAC_GetTransferEscapeEndFlag_C*<channel number>*	Get the transfer escape end flag

R_PG_DMAC_ClearTransferEscapeEndFlag_C*<channel number>*	Clear the escape transfer end flag
R_PG_DMAC_SetSrcAddress_C*<channel number>*	Set the source address
R_PG_DMAC_SetDestAddress_C*<channel number>*	Set the destination address
R_PG_DMAC_SetAddressOffset_C*<channel number>*	Set the address offset
R_PG_DMAC_SetExtendedRepeatSrc_C*<channel number>*	Set the source address extended repeat value
R_PG_DMAC_SetExtendedRepeatDest_C*<channel number>*	Set the destination address extended repeat value
R_PG_DMAC_StopModule_C*<channel number>*	Stop the DMAC channel

Data Transfer Controller (DTCa)

Generated Function	Description
R_PG_DTC_Set	Set up the DTC
R_PG_DTC_Set_*<trigger source>*	Set the DTC transfer data
R_PG_DTC_Activate	Make DTC be ready for the trigger
R_PG_DTC_SuspendTransfer	Stop transfer data
R_PG_DTC_GetTransmitStatus	Get transfer data status
R_PG_DTC_StopModule	Shut down the DTC

Event Link Controller (ELC)

Generated Function	Description
R_PG_ELC_Set	Sets the ELC
R_PG_ELC_SetLink_*<peripheral module>*	Sets an event link
R_PG_ELC_DisableLink_*<peripheral module>*	Disables an event link
R_PG_ELC_Set_PortGroup*<port group number>*	Sets a port group
R_PG_ELC_Set_SinglePort*<single-port number>*	Sets a single-port pin
R_PG_ELC_AllEventLinkEnable	Enables all event links
R_PG_ELC_AllEventLinkDisable	Disables all event links
R_PG_ELC_Generate_SoftwareEvent	Generates a software event
R_PG_ELC_GetPortBufferValue_Group*<port-group number>*	Acquires the value of a port buffer register
R_PG_ELC_SetPortBufferValue_Group*<port-group number>*	Sets a value for a port buffer register
R_PG_ELC_StopModule	Stops the ELC

I/O port

Generated Function	Description
R_PG_IO_PORT_Set_P*<port number>*	Set the I/O ports
R_PG_IO_PORT_Set_P*<port number><pin number>*	Set an I/O port (one pin)
R_PG_IO_PORT_Read_P*<port number>*	Read data from Port Input Register
R_PG_IO_PORT_Read_P*<port number><pin number>*	Read 1-bit data from Port Input Register
R_PG_IO_PORT_Write_P*<port number>*	Write data to Port Output Data Register
R_PG_IO_PORT_Write_P *<port number><pin number>*	Write 1-bit data to Port Output Data Register
R_PG_IO_PORT_SetPortNotAvailable	Handle unavailable pins

Multi-Function Timer Pulse Unit 2 (MTU2a)

Generated Function	Description
R_PG_Timer_Set_MTU_U*<unit number>*_*<channels>*	Set up the MTU
R_PG_Timer_StartCount_MTU_U*<unit number>*_C*<channel number>*	Start the MTU count operation

R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*>	Start the MTU count operation of two or more channels simultaneously
R_PG_Timer_HaltCount_MTU_U<*unit number*>_C<*channel number*>	Halt the MTU count operation
R_PG_Timer_GetCounterValue_MTU_U<*unit number*>_C<*channel number*>	Acquire the MTU counter value
R_PG_Timer_SetCounterValue_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>)	Set the MTU counter value
R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>	Acquire and clear the MTU interrupt flags
R_PG_Timer_StopModule_MTU_U<*unit number*>	Shut down the MTU unit
R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>	Acquire the general register value
R_PG_Timer_SetTGR_<*general register*>_MTU_U<*unit number*>_C<*channel number*>	Set the general register value
R_PG_Timer_SetBuffer_AD_MTU_U<*unit number*>_C<*channel number*>	Set A/D converter start request cycle set buffer registers (TADCOBRA and TADCOBRB)
R_PG_Timer_SetBuffer_CycleData_MTU_U<*unit number*>_<*channels*>	Set the cycle buffer register
R_PG_Timer_SetOutputPhaseSwitch_MTU_U<*unit number*>_<*channels*>	Switch PWM output level
R_PG_Timer_ControlOutputPin_MTU_U<*unit number*>_<*channels*>	Enable or disable the PWM output
R_PG_Timer_SetBuffer_PWMOutputLevel_MTU_U<*unit number*>_<*channels*>	Set the PWM output level in the buffer register
R_PG_Timer_ControlBufferTransfer_MTU_U<*unit number*>_<*channels*>	Enable or disable buffer transfer from the buffer registers to the temporary registers

Port Output Enable 2 (POE2a)

Generated Function	Description
R_PG_POE_Set	Set up the POE
R_PG_POE_SetHiZ_<*Timer channels*>	Place the timer output pins in high-impedance state
R_PG_POE_GetRequestFlagHiZ_<*Timer channels/flag*>	Acquire the high-impedance request flags
R_PG_POE_GetShortFlag_<*Timer channels*>	Acquire the MTU output short flags
R_PG_POE_ClearFlag_<*Timer channels/flag*>	Clear the high-impedance request flags and the output short flags

8-bit timer (TMR)

Generated Function	Description
R_PG_Timer_Start_TMR_U<*unit number*>(_C<*channel number*>)	Set a TMR and start it counting
R_PG_Timer_HaltCount_TMR_U<*unit number*>(_C<*channel number*>)	Halt counting by a TMR
R_PG_Timer_ResumeCount_TMR_U<*unit number*>(_C<*channel number*>)	Resume counting by a TMR
R_PG_Timer_GetCounterValue_TMR_U<*unit number*>(_C<*channel number*>)	Get the counter value of a TMR
R_PG_Timer_SetCounterValue_TMR_U<*unit number*>(_C<*channel*	Set the counter value of a TMR

number>)	
R_PG_Timer_GetRequestFlag_TMR_U<unit number>(_C<channel number>)	Acquire and clear the TMR interrupt flags
R_PG_Timer_HaltCountElc_TMR_U<unit number>_C<channel number>	Stop the TMR operation that was started by the ELC
R_PG_Timer_GetCountStateElc_TMR_U<unit number>_C<channel number>	Acquire the state of the TMR operation that was started by the ELC
R_PG_Timer_StopModule _TMR_U<unit number>	Stop a TMR unit

Compare Match Timer (CMT)

Generated Function	Description
R_PG_Timer_Set_CMT_U<unit number>_C<channel number>	Set up the CMT
R_PG_Timer_StartCount_CMT_U<unit number>_C<channel number>	Start or resume the CMT count operation
R_PG_Timer_HaltCount_CMT_U<unit number>_C<channel number>	Halt the CMT count
R_PG_Timer_GetCounterValue_CMT_U<unit number>_C<channel number>	Acquire the CMT counter value
R_PG_Timer_SetCounterValue_CMT_U<unit number>_C<channel number>	Set the CMT counter value
R_PG_Timer_StopModule _CMT_U<unit number>	Shut down the CMT unit

Realtime Clock (RTCc)

Generated Function	Description
R_PG_RTC_Start	Sets up the RTC and starts its counter
R_PG_RTC_WarmStart	Sets up the RTC of warm start and starts its counter
R_PG_RTC_Stop	Suspends counting by the RTC
R_PG_RTC_Restart	Restarts counting by the RTC
R_PG_RTC_SetCurrentTime	Sets the current time
R_PG_RTC_GetStatus	Acquires information on the current state of the RTC
R_PG_RTC_Adjust30sec	Performs 30-second unit adjustment
R_PG_RTC_ManualErrorAdjust	Corrects an error of the timer
R_PG_RTC_Set24HourMode	Places the RTC in 24-hour mode
R_PG_RTC_Set12HourMode	Places the RTC in 12-hour mode
R_PG_RTC_AutoErrorAdjust_Enable	Enables automatic correction of errors of the timer
R_PG_RTC_AutoErrorAdjust_Disable	Disables automatic correction of errors of the timer
R_PG_RTC_AlarmControl	Enables or disables alarms
R_PG_RTC_SetAlarmTime	Sets the time for an alarm
R_PG_RTC_SetPeriodicInterrupt	Specifies the cycle for generating the cyclic interrupt
R_PG_RTC_ClockOut_Enable	Enables the clock output
R_PG_RTC_ClockOut_Disable	Disables the clock output
R_PG_RTC_StartBinary	Sets u the RTC and starts its counter (binary count mode)
R_PG_RTC_StopBinary	Suspends counting by the RTC (binary count mode)

R_PG_RTC_RestartBinary	Restarts counting by the RTC (binary count mode)
R_PG_RTC_SetCurrentTimeBinary	Sets the current time (binay count mode)
R_PG_RTC_GetStatusBinary	Acquires information on the current state of the RTC (binary count mode)
R_PG_RTC_ManualErrorAdjustBinary	Corrects an error of the timer (binary count mode)
R_PG_RTC_AutoErrorAdjustBinary_Enable	Enables automatic correction of errors of the timer (binary count mode)
R_PG_RTC_AutoErrorAdjustBinary_Disable	Disables automatic correction of errors of the timer (binary count mode)
R_PG_RTC_SetAlarmTimeBinary	Sets the time for an alarm (binary count mode)
R_PG_RTC_SetPeriodicInterruptBinary	Specifies the cycle for generating the cyclic interrupt (binary count mode)
R_PG_RTC_ClockOutBinary_Enable	Enables the clock output (binary count mode)
R_PG_RTC_ClockOutBinary_Disable	Disables the clock output (binary count mode)

Independent Watchdog Timer (IWDTa)

Generated Function	Description
R_PG_Timer_Start_IWDT	Sets up the IWDT and starts its timer
R_PG_Timer_RefreshCounter_IWDT	Refresh the counter
R_PG_Timer_GetStatus_IWDT	Acquires the status flag and count value of IWDT

Serial Communications Interface (SCIe, SCIf)

Generated Function	Description
R_PG_SCI_Set_C<*channel number*>	Set a SCI channel
R_PG_SCI_SendTargetStationID_C<*channel number*>	Transmits the ID code of the receiving station
R_PG_SCI_StartSending_C<*channel number*>	Start the data transmission
R_PG_SCI_SendAllData_C<*channel number*>	Transmit all data
R_PG_SCI_I2CMode_Send_C<*channel number*>	Transmit data by simple I^{2}C bus interface
R_PG_SCI_I2CMode_SendWithoutStop_C<*channel number*>	Transmit data by simple I^{2}C bus interface (no stop condition)
R_PG_SCI_I2CMode_GenerateStopCondition_C<*channel number*>	Generate a stop condition
R_PG_SCI_I2CMode_Receive_C<*channel number*>	Receive data by simple I^{2}C bus interface
R_PG_SCI_I2CMode_RestartReceive_C<*channel number*>	Receive data by simple I^{2}C bus interface (RE-START condition)
R_PG_SCI_I2CMode_ReceiveLast_C<*channel number*>	Making reception complete in simple I^{2}C bus interface
R_PG_SCI_I2CMode_GetEvent_C<*channel number*>	Get the detected event in the simple I^{2}C mode

R_PG_SCI_SPIMode_Transfer_C<*channel number*>	Transmit data by simple SPI mode
R_PG_SCI_SPIMode_GetErrorFlag_C<*channel number*>	Get the serial reception error flag in the simple SPI mode
R_PG_SCI_GetSentDataCount_C<*channel number*>	Acquire the number of transmitted data
R_PG_SCI_ReceiveStationID_C<*channel number*>	Receives the ID code matches the ID of the receiving station itself
R_PG_SCI_StartReceiving_C<*channel number*>	Start the data reception
R_PG_SCI_ReceiveAllData_C<*channel number*>	Receive all data
R_PG_SCI_ControlClockOutput_C<*channel number*>	Control the output from the SCKn pin (n: 0, 1, 5, 6, 8, 9, or 12)
R_PG_SCI_StopCommunication_C<*channel number*>	Stop transmission and reception
R_PG_SCI_GetReceivedDataCount_C<*channel number*>	Acquire the number of received data
R_PG_SCI_GetReceptionErrorFlag_C<*channel number*>	Get the serial reception error flag
R_PG_SCI_ClearReceptionErrorFlag_C<*channel number*>	Clear the serial reception error flag
R_PG_SCI_GetTransmitStatus_C<*channel number*>	Get the state of transmission
R_PG_SCI_StopModule_C<*channel number*>	Shut down a SCI channel

I^{2}C Bus Interface (RIIC)

Generated Function	Description
R_PG_I2C_Set_C<*channel number*>	Set up the I^{2}C bus interface channel
R_PG_I2C_MasterReceive_C<*channel number*>	Master data reception
R_PG_I2C_MasterReceiveLast_C<*channel number*>	Complete a master reception process
R_PG_I2C_MasterSend_C<*channel number*>	Master data transmission
R_PG_I2C_MasterSendWithoutStop_C<*channel number*>	Master data transmission (No stop condition)
R_PG_I2C_GenerateStopCondition_C<*channel number*>	Generate the stop condition
R_PG_I2C_GetBusState_C<*channel number*>	Get the bus state
R_PG_I2C_SlaveMonitor_C<*channel number*>	Slave bus monitor
R_PG_I2C_SlaveSend_C<*channel number*>	Slave data transmission
R_PG_I2C_GetDetectedAddress_C<*channel number*>	Get the detected address
R_PG_I2C_GetTR_C<*channel number*>	Get the transmit/receive mode
R_PG_I2C_GetEvent_C<*channel number*>	Get the detected event
R_PG_I2C_GetReceivedDataCount_C<*channel number*>	Acquires the count of transmitted data
R_PG_I2C_GetSentDataCount_C<*channel number*>	Acquires the count of received data
R_PG_I2C_Reset_C<*channel number*>	Reset the bus
R_PG_I2C_StopModule_C<*channel number*>	Shut down the I^{2}C bus interface channel

Serial Peripheral Interface (RSPI)

Generated Function	Description
R_PG_RSPI_Set_C<*channel number*>	Set up a RSPI channel
R_PG_RSPI_SetCommand_C<*channel number*>	Set commands
R_PG_RSPI_StartTransfer_C<*channel number*>	Start the data transfer
R_PG_RSPI_TransferAllData_C<*channel number*>	Transfer all data
R_PG_RSPI_GetStatus_C<*channel number*>	Acquire the transfer status
R_PG_RSPI_GetError_C<*channel number*>	Acquire the error flags
R_PG_RSPI_GetCommandStatus_C<*channel number*>	Acquire the command status
R_PG_RSPI_LoopBack<*loopback mode*>_C<*channel number*>	Set loopback mode

R_PG_RSPI_StopModule_C<*channel number*>	Shut down a RSPI channel

CRC Calculator (CRC)

Generated Function	Description
R_PG_CRC_Set	Set up CRC calculator
R_PG_CRC_InputData	Input a data to CRC calculator
R_PG_CRC_GetResult	Get the the result of calculation
R_PG_CRC_StopModule	Shut down CRC Calculator

12-Bit A/D Converter (S12ADb)

Generated Function	Description
R_PG_ADC_12_Set_S12AD0	Sets up the 12-bit A/D converter
R_PG_ADC_12_StartConversionSW_S12AD0	Starts A/D conversion (by a software trigger)
R_PG_ADC_12_StopConversion_S12AD0	Stops A/D conversion
R_PG_ADC_12_GetResult_S12AD0	Gets the result of A/D conversion of an analog input or internal reference voltage
R_PG_ADC_12_GetResult_DblTrigger_S12AD0	Gets the result of A/D conversion in response to the second trigger in the double-trigger mode
R_PG_ADC_12_GetResult_SelfDiag_S12AD0	Gets the result of A/D conversion as part of self diagnosis by the A/D converter
R_PG_ADC_12_StopModule_S12AD0	Shuts down the 12-bit A/D converter

Comparator A (CMPA)

Generated Function	Description
R_PG_CPA_Set_CP<*comparator circuit number*>	Sets up comparator n n: A1 or A2
R_PG_CPA_Disable_CP<*comparator circuit number*>	Disable comparator n circuit n: A1 or A2
R_PG_CPA_GetStatus	Get comparator A status flag

Data Operation Circuit (DOC)

Generated Function	Description
R_PG_DOC_Set	Set up the Data Operation Circuit
R_PG_DOC_GetStatusFlag	Acquire the status of the data operation circuit
R_PG_DOC_GetResult	Acquire the result of data operation
R_PG_DOC_InputData	Input data
R_PG_DOC_UpdateData	Update data
R_PG_DOC_StopModule	Disable the data operation circuit

5.1 Clock-Generation Circuit

5.1.1 R_PG_Clock_Set

Definition: bool R_PG_Clock_Set(void)

Description: Set up the clocks

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Set

Details:

- Sets up each clock source and starts the oscillation.
- Switches the internal clock source to the clock which is specified on GUI.
- Sets the frequency of the system clock (ICLK), the peripheral module clocks (PCLKB and PCLKD), the FlashIF clock (FCLK), and the external bus clock (BCLK).

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Set the clock-generation circuit.
	R_PG_Clock_Set();
}
```

5.1.2 R_PG_Clock_WaitSet

Definition bool R_PG_Clock_WaitSet(double wait_time)

Description Set up the clocks

Parameter

double wait_time	Oscillation stabilization waiting time (in seconds)

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Clock.c

RPDL function R_CGC_Set

Details

- Sets up each clock source and starts the oscillation.
- Switches the internal clock source to the clock which is specified on GUI.
- This function inserts wait cycles before switching the internal clock source. If wait cycles are not required, use R_PG_Clock_Set.
- The actual waiting time may be different from the specified value.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Set the clock-generation circuit and switch the clock source after waiting 0.5 seconds.
	R_PG_Clock_WaitSet(0.5);
}
```

5.1.3 R_PG_Clock_Start_MAIN

Definition: bool R_PG_Clock_Start_MAIN(void)

Description: Start the main clock oscillator

Conditions for output: The main clock or PLL circuit is set to be used on GUI.

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Control

Details:
- Starts the main clock oscillator.
- If the main clock is set to be used on GUI, the main clock will start the oscillation in R_PG_Clock_Set.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
        //Start the main clock oscillator.
        R_PG_Clock_Start_MAIN();
}
```

5.1.4 R_PG_Clock_Stop_MAIN

Definition bool R_PG_Clock_Stop_MAIN(void)

Description Stop the main clock oscillator

Conditions for output The main clock or PLL circuit is set to be used on GUI.

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Clock.c

RPDL function R_CGC_Control

Details

- Stops the main clock oscillator.
- The main clock oscillator cannot be stopped when the main clock or PLL circuit is used as the internal clock source.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Stop the main clock oscillator.
	R_PG_Clock_Stop_MAIN();
}
```

5.1.5 R_PG_Clock_Start_SUB

Definition bool R_PG_Clock_Start_SUB(void)

Description Start the sub-clock oscillator

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Clock.c

RPDL function R_CGC_Control

Details

- Starts the sub-clock oscillator.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Start the sub-clock oscillator.
	R_PG_Clock_Start_SUB();
}
```

5.1.6 R_PG_Clock_Stop_SUB

Definition
bool R_PG_Clock_Stop_SUB(void)

Description
Stop the sub-clock oscillator

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_Clock.c

RPDL function
R_CGC_Control

Details

- Stops the sub-clock oscillator.
- The sub-clock oscillator cannot be stopped when the sub-clock is used as the internal clock source.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
        //Stop the sub-clock oscillator.
        R_PG_Clock_Stop_SUB();
}
```

5.1.7 R_PG_Clock_Start_LOCO

Definition bool R_PG_Clock_Start_LOCO(void)

Description Start the low-speed on-chip oscillator (LOCO)

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Clock.c

RPDL function R_CGC_Control

Details
- Starts the low-speed on-chip oscillator (LOCO).

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Start the low-speed on-chip oscillator (LOCO).
	R_PG_Clock_Start_LOCO();
}
```

5.1.8 R_PG_Clock_Stop_LOCO

Definition bool R_PG_Clock_Stop_LOCO(void)

Description Stop the low-speed on-chip oscillator (LOCO)

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Clock.c

RPDL function R_CGC_Control

Details

- Stops the low-speed on-chip oscillator (LOCO).
- The low-speed on-chip oscillator (LOCO) cannot be stopped when the LOCO is used as the internal clock source.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Stop the low-speed on-chip oscillator (LOCO).
	R_PG_Clock_Stop_LOCO();
}
```

5.1.9 R_PG_Clock_Start_HOCO

Definition	bool R_PG_Clock_Start_HOCO(void)
Description	Start the high-speed on-chip oscillator (HOCO)
Conditions for output	The high-speed on-chip oscillator (HOCO) is set to be used on GUI.
Parameter	None
Return value	true: Setting was made correctly false: Setting failed
File for output	R_PG_Clock.c
RPDL function	R_CGC_Control
Details	• Starts the high-speed on-chip oscillator (HOCO).

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Start the high-speed on-chip oscillator (HOCO).
	R_PG_Clock_Start_HOCO();
}
```

5.1.10 R_PG_Clock_Stop_HOCO

Definition: bool R_PG_Clock_Stop_HOCO(void)

Description: Stop the high-speed on-chip oscillator (HOCO)

Conditions for output: The high-speed on-chip oscillator (HOCO) is set to be used on GUI.

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Control

Details:

- Stops the high-speed on-chip oscillator (HOCO).
- The high-speed on-chip oscillator (HOCO) cannot be stopped when the HOCO is used as the internal clock source.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Stop the high-speed on-chip oscillator (HOCO).
	R_PG_Clock_Stop_HOCO();
}
```

5.1.11 R_PG_Clock_PowerON_HOCO

Definition
bool R_PG_Clock_PowerON_HOCO(void)

Description
Turn on the high-speed on-chip oscillator (HOCO) power supply

Conditions for output
The high-speed on-chip oscillator (HOCO) is set to be used on GUI.

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_Clock.c

RPDL function
R_CGC_Control

Details
- Turns on the power supply of the high-speed on-chip oscillator (HOCO)

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Turn on the HOCO power supply
	R_PG_Clock_PowerON_HOCO();
}
```

5.1.12 R_PG_Clock_PowerOFF_HOCO

Definition	bool R_PG_Clock_PowerON_HOCO(void)
Description	Turn off the high-speed on-chip oscillator (HOCO) power supply
Conditions for output	The high-speed on-chip oscillator (HOCO) is set to be used on GUI.

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output	R_PG_Clock.c
RPDL function	R_CGC_Control

Details

- Turns off the power supply of the high-speed on-chip oscillator (HOCO)

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Turn off the HOCO power supply
	R_PG_Clock_PowerOFF_HOCO();
}
```

5.1.13 R_PG_Clock_Enable_MAIN_StopDetection

Definition: bool R_PG_Clock_Enable_MAIN_StopDetection(void)

Description: Enable the main clock oscillation stop detection function

Conditions for output: The main clock oscillation stop detection function has been set on GUI.

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Control

Details:

- Enables the main clock oscillation stop detection function.
- If the main clock oscillation stop detection function has been set on GUI, the function is set up and enabled in R_PG_Clock_Set.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Enable main clock oscillation stop detection function
	R_PG_Clock_Enable_MAIN_StopDetection();
}
```

5.1.14 R_PG_Clock_Disable_MAIN_StopDetection

Definition: bool R_PG_Clock_Disable_MAIN_StopDetection(void)

Description: Disable the main clock oscillation stop detection function

Conditions for output: The main clock oscillation stop detection function has been set on GUI.

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Control

Details:

- Disables the main clock oscillation stop detection function.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
        //Disable main clock oscillation stop detection function
        R_PG_Clock_Disable_MAIN_StopDetection();
}
```

5.1.15 R_PG_Clock_GetFlag_MAIN_StopDetection

Definition: bool R_PG_Clock_GetFlag_MAIN_StopDetection (bool* stop)

Description: Acquire the main clock oscillation stop detection flag

Conditions for output: The main clock oscillation stop detection function has been set on GUI.

Parameter

bool* stop	The address of storage area for the main clock oscillation stop detection flag

Return value

true	Acquisition of the flag succeeded
false	Acquisition of the flag failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_GetStatus

Details

- Acquires the main clock oscillation stop detection flag.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

bool stop;

void func(void)
{
	//Acquire the main clock oscillation stop detection flag
	R_PG_Clock_GetFlag_MAIN_StopDetection( &stop );
}
```

5.1.16 R_PG_Clock_ClearFlag_MAIN_StopDetection

Definition: bool R_PG_Clock_ClearFlag_MAIN_StopDetection (void)

Description: Clear the main clock oscillation stop detection flag

Conditions for output: The main clock oscillation stop detection function has been set on GUI.

Parameter:

None

Return value:

true	Clearing succeeded
false	Clearing failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_Control

Details:
- Clears the main clock oscillation stop detection flag.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Clear the main clock oscillation stop detection flag
	R_PG_Clock_ClearFlag_MAIN_StopDetection();
}
```

5.1.17 R_PG_Clock_GetSelectedClockSource

Definition bool R_PG_Clock_GetSelectedClockSource (uint8_t* clock)

Description Acquire the current internal clock source

Parameter

uint8_t* clock	The address of storage area for the value that corresponds to current internal clock source Correspondence between clock sources and stored values 0:Low-speed on-chip oscillator 1:High-speed on-chip oscillator 2:Main clock 3:Sub-clock 4:PLL circuit

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_Clock.c

RPDL function R_CGC_GetStatus

Details

- Acquires the current internal clock source

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

uint8_t clock;

void func(void)
{
	//Acquire the current internal clock source
	R_PG_Clock_GetSelectedClockSource( &clock );
}
```

5.1.18 R_PG_Clock_GetClocksStatus

Definition bool R_PG_Clock_GetClocksStatus (bool* main, bool* sub, bool* loco, bool* iwdt, bool* hoco)

Description Acquire the status of the clocks

Parameter

bool* main	The address of storage area for the value of the main clock stop bit (0:Operating 1:Stopped)
bool* sub	The address of storage area for the value of the sub-clock stop bit (0:Operating 1:Stopped)
bool* loco	The address of storage area for the value of the low-speed on-chip oscillator stop bit (0:Operating 1:Stopped)
bool* iwdt	The address of storage area for the value of the IWDT-dedicated low-speed on-chip oscillator stop bit (0:Operating 1:Stopped)
bool* hoco	The address of storage area for the value of the high-speed on-chip oscillator stop bit (0:Operating 1:Stopped)

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_Clock.c

RPDL function R_CGC_GetStatus

Details
- Acquire the oscillation status of the clocks
- Specify the address of storage area for the item to be acquired. Specify 0 for a item that is not required.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool loco;

void func(void)
{
    //Acquire the status of the the low-speed on-chip oscillator
    R_PG_Clock_GetClocksStatus ( 0,   0,   &loco,   0,   0 );
}
```

5.1.19 R_PG_Clock_GetHOCOPowerStatus

Definition: bool R_PG_Clock_GetHOCOPowerStatus (bool* power)

Description: Acquire the status of high-speed on-chip oscillator (HOCO) power supply

Parameter

bool* power	The address of storage area for the value of the HOCO power supply bit (0:ON 1:OFF)

Return value

true	Acquisition of the flag succeeded
false	Acquisition of the flag failed

File for output: R_PG_Clock.c

RPDL function: R_CGC_GetStatus

Details

- Acquires the status of high-speed on-chip oscillator (HOCO) power supply.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

bool power;

void func(void)
{
	//Acquire the status of HOCO power supply
	R_PG_Clock_GetHOCOPowerStatus ( & power );
}
```

5.2 Voltage Detection Circuit (LVDAa)

5.2.1 R_PG_LVD_Set

Definition bool R_PG_LVD_Set (void)

Description Set up the voltage detection circuit (Voltage-monitoring 1 and Voltage-monitoring 2)

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_LVD.c

RPDL function R_LVD_Create

Details

- This function sets the operation (internal reset or interrupt) when low voltage is detected.
- Both Voltage-monitoring 1 and Voltage-monitoring 2 can be set up in one function call.
- Function R_PG_Clock_Set must be called before any use of this function.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set(); // The clock-generation circuit has to be set first.

    // Set up the voltage detection circuit(voltage-monitoring 1 and voltage-monitoring 2)
    R_PG_LVD_Set();
}
```

5.2.2 R_PG_LVD_GetStatus

Definition

bool R_PG_LVD_GetStatus
(bool * lvd1_detect, bool * lvd1_monitor, bool * lvd2_detect, bool * lvd2_monitor)

Description

Get the status flag of Voltage Detection Circuit

Parameter

bool * lvd1_detect	The address of storage area for Voltage Monitoring 1 Voltage Change Detection Flag
bool * lvd1_monitor	The address of storage area for Voltage Monitoring 1 Signal Monitor Flag
bool * lvd2_detect	The address of storage area for Voltage Monitoring 2 Voltage Change Detection Flag
bool * lvd2_monitor	The address of storage area for Voltage Monitoring 2 Signal Monitor Flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output

R_PG_LVD.c

RPDL function

R_LVD_GetStatus

Details

- This function acquires the status flag of Voltage Detection Circuit.
- Specify 0 for a flag that is not required.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool lvd1_det, lvd2_det;
bool lvd1_mon, lvd2_mon;

void func(void)
{
	// Get the status flag of Voltage Detection Circuit.
	R_PG_LVD_GetStatus(&lvd1_detect, &lvd1_monitor, &lvd2_detect,
&lvd2_monitor);

	if( lvd1_det ){
		//Processing when Voltage Monitoring 1 Voltage Change is detected
	}
	if( lvd2_det ){
		//Processing when Voltage Monitoring 2 Voltage Change is detected
	}
}
```

5.2.3 R_PG_LVD_ClearDetectionFlag_LVD<*Voltage Detection Circuit number*>

Definition: bool R_PG_LVD_ClearDetectionFlag_LVD<*Voltage Detection Circuit number*> (void)
<*Voltage Detection Circuit number*>: 1 or 2

Description: Clear Voltage Monitoring n Voltage Change Detection Flag n: 1 or 2

Parameter: None

Return value:

true	Clearing succeeded
false	Clearing failed

File for output: R_PG_LVD.c

RPDL function: R_LVD_Control

Details:
- This function clears Voltage Monitoring n Voltage Change Detection Flag. n: 1 or 2

Example:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Clear Voltage Monitoring 1 Voltage Change Detection Flag.
	R_PG_LVD_ClearDetectionFlag_LVD1();
}
```

5.2.4 R_PG_LVD_Disable_LVD<*Voltage Detection Circuit number*>

Definition: bool R_PG_LVD_Disable_LVD<*Voltage Detection Circuit number*> (void)
<*Voltage Detection Circuit number*>: 1 or 2

Description: Disable Voltage Monitoring n n: 1 or 2

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_LVD.c

RPDL function: R_LVD_Control

Details:

- This function disables Voltage Monitoring n. n: 1 or 2

Example:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Disable Voltage Monitoring 1.
	R_PG_LVD_Disable_LVD1();
}
```

5.3 Clock Frequency Accuracy Measurement Circuit (CAC)

5.3.1 R_PG_CAC_Set

Definition bool R_PG_CAC_Set(void)

Description Set up the CAC and start the measurement

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_CAC.c

RPDL function R_CAC_Create

Details

- Sets up the clock frequency accuracy measurement circuit (CAC) and starts the measurement.
- Call R_CGC_Set to set up the clocks before calling this function.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Set up the clocks
	R_PG_Clock_Set();

	//Set up the CAC and start the measurement
	R_PG_CAC_Set (void);
}
```

5.3.2 R_PG_CAC_ClearFlag_FrequencyError

Definition: bool R_PG_CAC_ClearFlag_FrequencyError(void)

Description: Clear the frequency error flag

Conditions for output: The frequency error interrupt (FERRF) is set to be enabled on GUI.

Parameter

None

Return value

true	Clearing succeeded
false	Clearing failed

File for output: R_PG_CAC.c

RPDL function: R_CAC_Control

Details

- Clear the frequency error flag

Example

A case where the setting has been made in the GUI as follows.

- The frequency error interrupt (FERRF) has been set
- CacErrIntFunc has been specified as the frequency error interrupt (FERRF) notification function name

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void CacErrIntFunc(void)
{
	//Operation when the frequency error interrupt occurs
	func2();

	//Clear the frequency error flag
	R_PG_CAC_ClearFlag_FrequencyErro();
}

void func1(void)
{
	//Set up the clocks
	R_PG_Clock_Set();

	//Set up the CAC and start the measurement
	R_PG_CAC_Set (void);
}
```

5.3.3 R_PG_CAC_ClearFlag_MeasurementEnd

Definition	bool R_PG_CAC_ClearFlag_MeasurementEnd(void)
Description	Clear the measurement end flag
Conditions for output	The measurement end interrupt (MENDF) is set to be enabled on GUI.

Parameter

None	

Return value

true	Clearing succeeded
false	Clearing failed

File for output	R_PG_CAC.c
RPDL function	R_CAC_Control

Details

- Clear the measurement end flag

Example

A case where the setting has been made in the GUI as follows.

- The measurement end interrupt (MENDF) has been set
- CacEndIntFunc has been specified as the measurement end interrupt (MENDF) notification function name

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void CacEndIntFunc(void)
{
        //Operation when the frequency error interrupt occurs
        func2();

        //Clear the measurement end flag
        R_PG_CAC_ClearFlag_MeasurementEnd();
}

void func1(void)
{
        //Set up the clocks
        R_PG_Clock_Set();

        //Set up the CAC and start the measurement
        R_PG_CAC_Set (void);
}
```

5.3.4 R_PG_CAC_ClearFlag_Overflow

Definition: bool R_PG_CAC_ClearFlag_Overflow(void)

Description: Clear the overflow flag

Conditions for output: The overflow interrupt (OVFF) is set to be enabled on GUI.

Parameter:

None

Return value:

true	Clearing succeeded
false	Clearing failed

File for output: R_PG_CAC.c

RPDL function: R_CAC_Control

Details:

- Clear the overflow flag

Example: A case where the setting has been made in the GUI as follows.

- The overflow interrupt (OVFF) has been set
- CacOvIntFunc has been specified as the overflow interrupt (OVFF) notification function name

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void CacOvIntFunc(void)
{
	//Operation when the overflow interrupt occurs
	func2();

	//Clear the overflow flag
	R_PG_CAC_ClearFlag_Overflow();
}

void func1(void)
{
	//Set up the clocks
	R_PG_Clock_Set();

	//Set up the CAC and start the measurement
	R_PG_CAC_Set (void);
}
```

5.3.5 R_PG_CAC_StartMeasurement

Definition bool R_PG_CAC_StartMeasurement(void)

Description Start the measurement

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_CAC.c

RPDL function R_CAC_Control

Details

- Resumes the measurement which has been stopped by R_PG_CAC_StopMeasurement.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func1(void)
{
	//Stop the measurement
	R_PG_CAC_StopMeasurement();
}

void func2(void)
{
	//Start the measurement
	R_PG_CAC_StartMeasurement();
}
```

5.3.6 R_PG_CAC_StopMeasurement

Definition: bool R_PG_CAC_StopMeasurement(void)

Description: Stop the measurement

Parameter:

None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_CAC.c

RPDL function: R_CAC_Control

Details:

- Stops the measurement

Example:

Refer to the example of R_PG_CAC_StartMeasurement.

5.3.7 R_PG_CAC_GetStatusFlags

Definition bool R_PG_CAC_GetStatusFlags(bool *err, bool *end, bool *ov)

Description Acquire the CAC status flags

Parameter

bool *err	The address of storage area for the frequency error flag
bool *end	The address of storage area for the measurement end flag
bool *ov	The address of storage area for the overflow flag

Return value

true	Acquisition of the flags succeeded
false	Acquisition of the flags failed

File for output R_PG_CAC.c

RPDL function R_CAC_GetStatus

Details

- Acquires the frequency error flag, the measurement end flag and the overflow flag.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

bool    g_err;
bool    g_end;
bool    g_ov;

void func(void)
{
        //Acquire the CAC status flags
        bool R_PG_CAC_GetStatusFlags(&g_err, &g_end, &g_ov);
}
```

5.3.8 R_PG_CAC_GetCounterBufferRegister

Definition: bool R_PG_CAC_GetCounterBufferRegister(uint16_t *cacntbr_val)

Description: Acquire the counter buffer register (CACNTBR) value

Parameter

uint16_t *cacntbr_val	The address of storage area for the counter buffer register (CACNTBR) value

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output: R_PG_CAC.c

RPDL function: R_CAC_GetStatus

Details

- Acquires the counter buffer register (CACNTBR) value

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

uint16_t cacntbr_val;

void func(void)
{
	//Acquire the counter buffer register value
	R_PG_CAC_GetCounterBufferRegister( &cacntbr_val );
}
```

5.3.9 R_PG_CAC_StopModule

Definition bool R_PG_CAC_StopModule(void)

Description Shut down the CAC

Parameter

None

Return value

true	Stopping succeeded
false	Stopping failed

File for output R_PG_CAC.c

RPDL function R_CAC_Destroy

Details

- Shuts down the clock frequency accuracy measurement circuit (CAC).

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include “R_PG_default.h”

void func(void)
{
	//Shut down the CAC
	R_PG_CAC_StopModule();
}
```

5.4 Low Power Consumption

5.4.1 R_PG_LPC_Set

Definition bool R_PG_LPC_Set (void)

Description Set up the low power consumption functions.

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Create

Details
- This function configures the low power conditions.
- Call this function before starting the clock source for which you have set the oscillation settling time through the GUI.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    //Stop the sub-clock oscillator.
    R_PG_Clock_Stop_SUB();
    // Set up the low power consumption functions.
    R_PG_LPC_Set (void);
    //Start the sub-clock oscillator.
    R_PG_Clock_Start_SUB();
    //Set the clock-generation circuit and switch the clock source after waiting 2 seconds.
    R_PG_Clock_WaitSet(2);
}
```

5.4.2 R_PG_LPC_Sleep

Definition bool R_PG_LPC_Sleep (void)

Description Enter sleep mode.

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Control

Details

- This function set the system to sleep mode.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Enter sleep mode.
	R_PG_LPC_Sleep(void);
}
```

5.4.3 R_PG_LPC_AllModuleClockStop

Definition bool R_PG_LPC_AllModuleClockStop (void)

Description Enter all module clock stop mode.

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Control

Details

- This function sets the system to all module clock stop mode.
- Before entering all module clock stop mode, this function sets TMR unit which is allowed to operate while all module clock stop mode.
- By default, TMR stops while the MCU is in all module clock stop mode. To prevent stopping TMR in all module clock stop mode, select the TMR unit that you wish to operate through the GUI.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Enter all module clock stop mode.
	R_PG_LPC_AllModuleClockStop (void);
}
```

5.4.4 R_PG_LPC_SoftwareStandby

Definition bool R_PG_LPC_SoftwareStandby(void)

Description Enter software standby mode.

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Control

Details

- This function set the system to software standby mode.
- Call R_PG_LPC_Set before calling this function to set the operation during software standby mode.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Set up the low power consumption functions.
	R_PG_LPC_Set (void);

	// Enter software standby mode.
	R_PG_LPC_SoftwareStandby (void);
}
```

5.4.5 R_PG_LPC_ChangeOperatingPowerControl

Definition bool R_PG_LPC_ChangeOperatingPowerControl(uint8_t mode)

Description Change the operating power control mode

Parameter

uint8_t mode	Operating power control mode 0 : High-speed operating mode 1 : Middle-speed operating mode A 2 : Middle-speed operating mode B 3 : Low-speed operating mode 1 4 : Low-speed operating mode 2

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Control

Details

- Changes the operating power control mode.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
void func(void)
{
	// Change the operating power control mode to middle-speed operating mode A
	R_PG_LPC_ChangeOperatingPowerControl( 1 );
}
```

5.4.6 R_PG_LPC_ChangeSleepModeReturnClock

Definition bool R_PG_LPC_ChangeSleepModeReturnClock(uint8_t return_clock)

Description Change the sleep mode return clock source

Parameter

uint8_t return_clock	Sleep mode return clock source 0:Switching is disabled 1:HOCO 2:Main clock oscillator)

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_LPC.c

RPDL function R_LPC_Control

Details

- Changes the sleep mode return clock source.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
void func(void)
{
	// Change the sleep mode return clock source to HOCO
	R_PG_LPC_ChangeSleepModeReturnClock( 1 );
}
```

5.4.7 R_PG_LPC_GetPowerOnResetFlag

Definition bool R_PG_LPC_GetPowerOnResetFlag (bool *reset)

Description Acquire the value of the power-on reset flag.

Parameter

bool *reset	The address of storage area for the power-on reset flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_LPC.c

RPDL function R_LPC_GetStatus

Details

- This function acquires the value of the power-on reset flag.
- The reset detection flags and the deep software standby cancel request flags are cleared by calling this function. Use R_PG_LPC_GetStatus instead of this function to get these flags simultaneously if needed.
- RSTSR.PORF(power-on reset flag) is only initialized by a pin reset.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool reset;

void func(void)
{
    // Acquire the power-on reset flags.
    R_PG_LPC_GetPowerOnResetFlag( &reset );

    if( reset ){
        // Processing when the power-on reset is detected
    }
}
```

5.4.8 R_PG_LPC_GetLVDDetectionFlag

Definition bool R_PG_LPC_GetLVDDetectionFlag (bool * lvd0, bool * lvd1, bool * lvd2)

Description Acquire the value of the LVD detection flags.

Parameter

bool * lvd0	The address of storage area for the LVD0 detection flag
bool * lvd1	The address of storage area for the LVD1 detection flag
bool * lvd2	The address of storage area for the LVD2 detection flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_LPC.c

RPDL function R_LPC_GetStatus

Details
- This function acquires the value of the LVD detection flags.
- Specify the address of storage area for the flags to be acquired.
- Specify 0 for a flag that is not required.
- The reset detection flags and the deep software standby cancel request flags are cleared by calling this function. Use R_PG_LPC_GetStatus instead of this function to get these flags simultaneously if needed.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool lvd1;
bool lvd2;

void func(void)
{
	// Acquire the LVD1 and LVD2 flags.
	R_PG_LPC_GetLVDDetectionFlag ( 0, &lvd1, &lvd2 );

	if( lvd1 ){
		//Processing when the LVD1 is detected
	}
	if( lvd2 ){
		//Processing when the LVD2 is detected
	}
}
```

5.4.9 R_PG_LPC_GetOperatingPowerControlFlag

Definition bool R_PG_LPC_GetOperatingPowerControlFlag(bool * during_transition)

Description Acquire the value of the operating power control mode transition flag

Parameter

bool * during_transition	The address of the storage area for the operating power control mode transition flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_LPC.c

RPDL function R_LPC_GetStatus

Details

- This function acquires the value of the operating power control mode transition flag.
- The reset detection flags and the deep software standby cancel request flags are cleared by calling this function. Use R_PG_LPC_GetStatus instead of this function to get these flags simultaneously if needed.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool during_transition;

void func(void)
{
	// Acquire the operating power control mode transition flag
	R_PD_LPC_GetOperatingPowerControlFlag ( &during_transition );
}
```

5.4.10 R_PG_LPC_GetStatus

Definition bool R_PG_LPC_GetStatus(uint16_t *data)

Description Get the status of the low power consumption functions.

Parameter

uint16_t *data	The address of storage area for the status data

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_LPC.h

RPDL function R_LPC_GetStatus

Details

- This function acquires the reset status.
- When calling this function, the function of RPDL R_PG_LPC_GetStatus is called directly.
- The status flags shall be stored in the format below.

B15-b9	b8
0	Operating Power Control Mode transition flag 0: Transition completed 1: During Transition

b7-b4	b3	b2	b1	b0
Reset status (RSTSR0) (0: not detected; 1: detected)				
0	LVD2	LVD1	LVD0	Power-on reset

- The RSTSR(LVD detection flags) are cleared by calling this function.
- RSTSR.PORF(power-on reset flag) is only initialized by a pin reset.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
uint16_t data;
void func(void)
{
    // Acquire the LPC status
    R_PG_LPC_GetStatus( &data );
}
```

5.5 Register Write Protection Function

5.5.1 R_PG_RWP_RegisterWriteCgc

Definition: bool R_PG_RWP_RegisterWriteCgc (bool enable)

Description: Enables or disables writing to registers associated with the clock generation circuit

Parameter

bool enable	Whether writing to registers is enabled or disabled (1: enabled, 0: disabled)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RWP.c

RPDL function: R_RWP_Control

Details
- Enables or disables writing to registers associated with the clock generation circuit.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool cgc;
bool mode_lpc_reset;
bool lvd;
bool b0wi,pfswe;

void func1(void)
{
    // Enable writing to registers associated with the clock generation circuit.
    R_PG_RWP_RegisterWriteCgc( 1 );

    // Enable writing to registers associated with the operating mode,
    // low power comsumption, and software reset.
    R_PG_RWP_RegisterWriteModeLpcReset( 1 );

    // Enable writing to registers associated with LVD.
    R_PG_RWP_RegisterWriteLvd( 1 );

    // Enable writing to pin-function selection registers.
    R_PG_RWP_RegisterWriteMpc( 1 );
}

void func2(void)
{
    // Disable writing to registers associated with the clock generation circuit.
    R_PG_RWP_RegisterWriteCgc( 0 );

    // Disable writing to registers associated with the operating mode,
    // low power comsumption, and software reset.
    R_PG_RWP_RegisterWriteModeLpcReset( 0 );

    // Disable writing to registers associated with LVD.
    R_PG_RWP_RegisterWriteLvd( 0 );

    // Disable writing to pin-function selection registers.
    R_PG_RWP_RegisterWriteMpc( 0 );
```

```
}

void func3(void)
{
    // Acquire the value indicating whether writing to registers associated with the clock
    // generation circuit is enabled or disabled.
    R_PG_RWP_GetStatusCgc(&cgc);

    // Acquire the value indicating whether writing to registers associated with
    // the operating mode, low power comsumption, and software reset is enabled or
    // disabled.
    R_PG_RWP_GetStatusModeLpcReset(&mode_lpc_reset);

    // Acquire the value indicating whether writing to registers associated with LVD is
    // enabled or disabled.
    R_PG_RWP_GetStatusLvd(&lvd);

    // Acquire the value indicating whether writing to pin-function selection registers is
    // enabled or disabled.
    R_PG_RWP_GetStatusMpc(&b0wi, &pfswe);
}
```

5.5.2 R_PG_RWP_RegisterWriteModeLpcReset

Definition bool R_PG_RWP_RegisterWriteModeLpcReset (bool enable)

Description Enables or disables writing to registers associated with the operating mode, low power comsumption, and software reset

Parameter

bool enable	Whether writing to registers is enabled or disabled (1: enabled, 0: disabled)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RWP.c

RPDL function R_RWP_Control

Details

- Enables or disables writing to registers associated with the operating mode, low power comsumption, and software reset.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.3 R_PG_RWP_RegisterWriteLvd

Definition bool R_PG_RWP_RegisterWriteLvd (bool enable)

Description Enables or disables writing to registers associated with LVD

Parameter

bool enable	Whether writing to registers is enabled or disabled (1: enabled, 0: disabled)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RWP.c

RPDL function R_RWP_Control

Details
- Enables or disables writing to registers associated with LVD.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.4 R_PG_RWP_RegisterWriteMpc

Definition bool R_PG_RWP_RegisterWriteMpc (bool enable)

Description Enables or disables writing to pin-function selection registers

Parameter

bool enable	Whether writing to registers is enabled or disabled (1: enabled, 0: disabled)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RWP.c

RPDL function R_RWP_Control

Details
- Enables or disables writing to pin-function selection registers.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.5 R_PG_RWP_GetStatusCgc

Definition bool R_PG_RWP_GetStatusCgc (bool * cgc)

Description Acquires a value indicating whether writing to registers associated with the clock generation circuit is enabled or disabled

Parameter

bool * cgc	Whether writing to registers associated with the clock generation circuit is enabled or disabled (1: enabled, 0: disabled)

Return value

true	The value of the flag was successfully acquired.
false	Acquisition of the value of the flag failed.

File for output R_PG_RWP.c

RPDL function R_RWP_GetStatus

Details

- Acquires a value indicating whether writing to registers associated with the clock generation circuit is enabled or disabled.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.6 R_PG_RWP_GetStatusModeLpcReset

Definition bool R_PG_RWP_GetStatusModeLpcReset (bool * mode_lpc_reset)

Description Acquires a value indicating whether writing to registers associated with the operating mode, low power comsumption, and software reset is enabled or disabled

Parameter

bool * mode_lpc_reset	Whether writing to registers associated with the operating mode, low power consumption, and software reset is enabled or disabled (1: enabled, 0: disabled)

Return value

true	The value of the flag was successfully acquired.
false	Acquisition of the value of the flag failed.

File for output R_PG_RWP.c

RPDL function R_RWP_GetStatus

Details
- Acquires a value indicating whether writing to registers associated with the operating mode, low power comsumption, and software reset is enabled or disabled.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.7 R_PG_RWP_GetStatusLvd

Definition: bool R_PG_RWP_GetStatusLvd (bool * lvd)

Description: Acquires a value indicating whether writing to registers associated with LVD is enabled or disabled

Parameter

bool * lvd	Whether writing to registers associated with LVD is enabled or disabled (1: enabled, 0: disabled)

Return value

true	The value of the flag was successfully acquired.
false	Acquisition of the value of the flag failed.

File for output: R_PG_RWP.c

RPDL function: R_RWP_GetStatus

Details:

- Acquires a value indicating whether writing to registers associated with LVD is enabled or disabled.

Example: Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.5.8 R_PG_RWP_GetStatusMpc

Definition bool R_PG_RWP_GetStatusMpc (bool * b0wi, bool * pfswe)

Description Acquires a value indicating whether writing to pin-function selection registers is enabled or disabled

Parameter

bool * b0wi	Whether writing to the PFSWE bit in the PWPR register is enabled or disabled (1: enabled, 0: disabled)
bool * pfswe	Whether writing to the PFS register is enabled or disabled (1: enabled, 0: disabled)

Return value

true	The value of the flag was successfully acquired.
false	Acquisition of the value of the flag failed.

File for output R_PG_RWP.c

RPDL function R_RWP_GetStatus

Details
- Acquires a value indicating whether writing to pin-function selection registers is enabled or disabled.

Example Refer to the example of R_PG_RWP_RegisterWriteCgc.

5.6 Interrupt Controller (ICUb)

5.6.1 R_PG_ExtInterrupt_Set_<*interrupt type*>

Definition
bool R_PG_ExtInterrupt_Set_<*interrupt type*> (void)
<*interrupt type*>: IRQ0 to IRQ7 or NMI

Description
Set up an external interrupt

Parameter
None

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_ExtInterrupt_<*interrupt type*>.c
<*interrupt type*>: IRQ0 to IRQ7 or NMI

RPDL function
R_INTC_SetExtInterrupt, R_INTC_CreateExtInterrupt

Details

- The Multifunction Pin Control registers are modified to enable each selected IRQ pin and the I/O Port PMR and PDR registers are modified to set the pin as an input. For IRQn, the pin to be used is set according to the selection in the [Peripheral Pin Usage] window.
- When the name of the interrupt notification function has been specified in the GUI, if an interrupt occurs in the CPU, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of this chapter end, Notes on Notification Functions.
- If the interrupt propriety level is set to 0 in the GUI, an interrupt handler will not be called even when the external interrupt is input. The request flag can be acquired by calling R_PG_ExtInterrupt_GetRequestFlag_<*interrupt type*> and the flag can be cleared by R_PG_ExtInterrupt_ClearRequestFlag_<*interrupt type*>.
- If [Enable digital filter] is specified in the GUI, the digital filter is enabled when called this function.

Example1
A case where Irq0IntFunc has been specified as the name of an interrupt notification function:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set IRQ0.
	R_PG_ExtInterrupt_Set_IRQ0();
}

//IRQ0 notification function
void Irq0IntFunc (void)
{
	func_irq0();	//Processing of IRQ0
}
```

Example2 A case where the interrupt propriety level is set to 0:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	bool flag;

	//Set IRQ0.
	R_PG_ExtInterrupt_Set_IRQ0();

	do{
		//Acquire the interrupt request flag for IRQ0.
		R_PG_ExtInterrupt_GetRequestFlag_IRQ0( &flag );
	}while( ! flag );

	func_irq0();	//Processing of IRQ0

	//Clear the interrupt request flag for IRQ0.
	R_PG_ExtInterrupt_ClearRequestFlag_IRQ0();
}
```

5.6.2 R_PG_ExtInterrupt_Disable_*<interrupt type>*

Definition
: bool R_PG_ExtInterrupt_Disable_<*interrupt type*> (void)
  <*interrupt type*>: IRQ0 to IRQ7

Description
: Disable an external interrupt

Parameter
: None

Return value

true	Disabling was made correctly
false	Disabling failed

File for output
: R_PG_ExtInterrupt_<*interrupt type*>.c
  <*interrupt type*>: IRQ0 to IRQ7

RPDL function
: R_INTC_ControlExtInterrupt

Details
- Disables an external interrupt (IRQ0 to IRQ7).
- Settings of MPC and I/O ports registers for the pin being used for the external interrupt signal are retained.
- When disabling an IRQn pin, the Interrupt Request flag will be cleared automatically.
- When the name of the interrupt notification function has been specified in the GUI, the function having the specified name may be called once more if a valid event occurs just before the interrupt pin is disabled.

Example
: A case where Irq0IntFunc has been specified as the name of an interrupt notification function:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set IRQ0.
	R_PG_ExtInterrupt_Set_IRQ0();
}

//External interrupt (IRQ0) notification function
void Irq0IntFunc (void)
{
	//Disable IRQ0.
	R_PG_ExtInterrupt_Disable_IRQ0();

	func_irq0();	//Processing of IRQ0
}
```

5.6.3 R_PG_ExtInterrupt_GetRequestFlag_<*interrupt type*>

Definition: bool R_PG_ExtInterrupt_GetRequestFlag_<*interrupt type*> (bool * flag)
<*interrupt type*>: IRQ0 to IRQ7 or NMI

Description: Get an external interrupt request flag

Parameter:

bool * flag	The address of storage area for the interrupt request flag

Return value:

true	Acquisition succeeded
false	Acquisition failed

File for output: R_PG_ExtInterrupt_<*interrupt type*>.c
<*interrupt type*>: IRQ0 to IRQ7 or NMI

RPDL function: R_INTC_GetExtInterruptStatus

Details:

- Acquires the interrupt request flag for an external interrupt (IRQ0 to IRQ7 or the NMI). When an interrupt is requested, ‘true’ is entered in the specified destination for storage of the flag’s value.

Example: Refer to the Example2 of R_PG_ExtInterrupt_Set_<*interrupt type*>

5.6.4 R_PG_ExtInterrupt_ClearRequestFlag_*<interrupt type>*

Definition bool R_PG_ExtInterrupt_ClearRequestFlag_*<interrupt type>* (void)
<interrupt type>: IRQ0 to IRQ7 or NMI

Description Clear an external interrupt request flag

Parameter None

Return value

true	Clearing flag succeeded
false	Clearing flag failed

File for output R_PG_ExtInterrupt_*<interrupt type>*.c
<interrupt type>: IRQ0 to IRQ7 or NMI

RPDL function R_INTC_ControlExtInterrupt

Details
- Clears the interrupt request flag for an external interrupt (IRQ0 to IRQ7 or NMI).
- If the level-sensitive interrupt is selected, the interrupt request flag is cleared when high-level is input to the interrupt pin. The request flag of level-sensitive interrupt cannot be cleared by this function.

Example Refer to the Example2 of R_PG_ExtInterrupt_Set_*<interrupt type>*

5.6.5 R_PG_ExtInterrupt_EnableFilter_<*interrupt type*>

Definition
bool R_PG_ExtInterrupt_EnableFilter_<*interrupt type*> (uint32_t div)
<*interrupt type*>: IRQ0 to IRQ7 or NMI

Description
Re-enable the digital filter

Conditions for output
When [Enable digital filter] is specified in the GUI.

Parameter

uint32_t div	Peripheral module clock division values 1: digital filter sampling clock = PCLK 8: digital filter sampling clock = PCLK/8 32: digital filter sampling clock = PCLK/32 64: digital filter sampling clock = PCLK/64

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_ExtInterrupt_<*interrupt type*>.c
<*interrupt type*>: IRQ0 to IRQ7 or NMI

RPDL function
R_INTC_ControlExtInterrupt

Details
- The digital filter disabled by R_PG_ExtInterrupt_DisableFilter_<*interrupt type*> is enabled, and digital filter sampling clock is set again.

Example
When [Use IRQ0] is specified in the GUI ([Enable digital filter] is specified)

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
	R_PG_Clock_Set();	//The clock-generation circuit has to be set first.
	R_PG_ExtInterrupt_Set_IRQ0();	//Set IRQ0 (Enabling digital filter)
}

void func2(void)
{
	R_PG_ExtInterrupt_DisableFilter_IRQ0();	//Disabling digital filter

	R_PG_ExtInterrupt_EnableFilter_IRQ0( 1 );	//Re-enabling the digital filter
}
```

5.6.6 R_PG_ExtInterrupt_DisableFilter_<*interrupt type*>

Definition: bool R_PG_ExtInterrupt_DisableFilter_<*interrupt type*> (void)
<*interrupt type*>: IRQ0 to IRQ7 or NMI

Description: Disable the digital filter

Conditions for output: When [Enable digital filter] is specified in the GUI.

Parameter: None

Return value:

true	Disabling was made correctly
false	Disabling failed

File for output: R_PG_ExtInterrupt_<*interrupt type*>.c
<*interrupt type*>: IRQ0 to IRQ7 or NMI

RPDL function: R_INTC_ControlExtInterrupt

Details:
- The digital filter is disabled.
- Disable the digital filter before transition to Software Standby Mode. To use the digital filter again after return from software standby mode, call R_PG_ExtInterrupt_EnableFilter_<*interrupt type*>.

Example: Refer to the example of R_PG_ExtInterrupt_EnableFilter_<*interrupt type*>

5.6.7 R_PG_SoftwareInterrupt_Set

Definition bool R_PG_SoftwareInterrupt_Set(void)

Description Set up the software interrupt

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_SoftwareInterrupt.c

RPDL function R_INTC_CreateSoftwareInterrupt

Details
- Sets up the software interrupt.
- The software interrupt cannot be generated by calling this function. To generate the software interrupt, call R_PG_SoftwareInterrupt_Generate.

Example A case where SwIntFunc was specified as the name of the software interrupt notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
void SwIntFunc(void);

void func(void)
{
	//Set up the software interrupt
	R_PG_SoftwareInterrupt_Set();

	//Generate the software interrupt
	R_PG_SoftwareInterrupt_Generate();
}

void SwIntFunc(void)
{
	//Processing of software interrupt
}
```

5.6.8 R_PG_SoftwareInterrupt_Generate

Definition bool R_PG_SoftwareInterrupt_Generate(void)

Description Generate the software interrupt

Parameter None

Return value

true	Generating was made correctly
false	Generating failed

File for output R_PG_SoftwareInterrupt.c

RPDL function R_INTC_Write

Details
- Generates the software interrupt.
- Call R_PG_SoftwareInterrupt_Set before calling this function to set up the software interrupt.

Example Refer to the example of R_PG_SoftwareInterrupt_Set

5.6.9 R_PG_FastInterrupt_Set

Definition bool R_PG_FastInterrupt_Set (void)

Description Set up the fast interrupt

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_FastInterrupt.c

RPDL function R_INTC_CreateFastInterrupt

Details

- Sets the interrupt source specified in the GUI as the fast interrupt. The specified interrupt source is not set or enabled. The interrupt source to be set as the fast interrupt must be set and enabled by the functions for the peripheral module.
- This function uses an unconditional trap instruction (BRK) to set the fast-interrupt vector register (FINTV). If interrupts are disabled (the interrupt enable bit (I) of the processor status word is 0), this function will be locked.
- The interrupt handler that is specified as a fast interrupt will be compiled as a fast interrupt handler by specifying fint in #pragma interrupt declaration.

Example A case where IRQ0 has been specified as the fast interrupt in the GUI:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    //Set IRQ0 as the fast interrupt.
    R_PG_FastInterrupt_Set ();

    //Set IRQ0.
    R_PG_ExtInterrupt_Set_IRQ0();
}
```

5.6.10 R_PG_Exception_Set

Definition bool R_PG_Exception_Set (void)

Description Set the exception handlers

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Exception.c

RPDL function R_INTC_CreateExceptionHandlers

Details

- Sets the exception notification functions. If an exception for which the name of the exception notification function was specified in the GUI occurs after this function is called, the function with the specified name will be called.
  Create the exception notification function as follows:
  void <*name of the exception notification function*> (void)
  For the exception notification function, note the contents of this chapter end, Notes on Notification Functions.

Example A case where the following exception notification functions have been set in the GUI:
Privileged instruction exception: PrivInstExcFunc
Undefined instruction exception: UndefInstExcFunc

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set the exception handlers.
	R_PG_Exception_Set();
}

void PrivInstExcFunc(){
	func_pi_excep();	//Processing in response to a privileged instruction exception
}

void UndefInstExcFunc (){
	func_ui_excep();	//Processing in response to an undefined instruction exception
}
```

5.7 Buses

5.7.1 R_PG_ExtBus_PresetBus

Definition bool R_PG_ExtBus_PresetBus(void)

Description Set the bus priority

Conditions for output The bus priority has been set on GUI

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_ExtBus.c

RPDL function R_BSC_Set

Details

- Sets the bus priority.
- If required, call this function before calling R_PG_ExtBus_SetBus.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
        R_PG_ExtBus_PresetBus();        // Set the bus priority
        R_PG_ExtBus_SetBus();        //Set up the bus error monitoring.
}
```

5.7.2 R_PG_ExtBus_SetBus

Definition bool R_PG_ExtBus_SetBus(void)

Description Set up the bus error monitoring

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_ExtBus.c

RPDL function R_BSC_Create

Details
- Sets up the bus error monitoring.
- The bus error interrupt is set by this function. If the bus error interrupt has been set to be enabled on GUI, the function having the specified name will be called when an interrupt occurs. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of the section Notes on Notification Functions.
- The status of bus error generation can be acquired by calling R_PG_ExtBus_GetErrorStatus.
- If required, call R_PG_ExtBus_PresetBus before calling this function.

Example A case where BusErrFunc has been specified as the name of the bus error interrupt notification function.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_ExtBus_SetBus();	//Set up the bus error monitoring.
}

//Bus error notification function
void BusErrFunc(void)
{
	bool addr_err;
	uint8_t master;
	uint16_t err_addr;

	//Aquire bus error status
	R_PG_ExtBus_GetErrorStatus(&addr_err, &master, &err_addr);
	if( addr_err ){
		//Processing when illegal address access error occurs
	}

	//Clear the bus error status registers
	R_PG_ExtBus_ClearErrorFlags();
}
```

5.7.3 R_PG_ExtBus_GetErrorStatus

Definition

bool R_PG_ExtBus_GetErrorStatus
(bool * addr_err, uint8_t * master, uint16_t * err_addr)

Description

Acquire the status of bus error generation

Parameter

bool * addr_err	The address of storage area for the illegal address access error flag
uint8_t * master	The address of storage area for ID code of bus master that accessed a bus when a bus error occurred ID code of bus master: 0:CPU 3:DMAC/DTC
uint16_t * err_addr	The address of storage area for upper 13 bits of an address that was accessed when a bus error occurred

Return value

true	Acquisition succeeded.
false	Acquisition failed.

File for output

R_PG_ExtBus.c

RPDL function

R_BSC_GetStatus

Details

- Acquires the status of bus error generation from the bus error status registers.
- Specify the address of storage area for an item to be acquired. Specify 0 for an item that is not required.

Example

A case where BusErrFunc has been specified as the name of the bus error interrupt notification function.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set up the bus error monitoring.
	R_PG_ExtBus_SetBus();
}

//Bus error notification function
void BusErrFunc(void)
{
	bool addr_err;
	uint8_t master;
	uint16_t err_addr;

	//Aquire bus error status
	R_PG_ExtBus_GetErrorStatus(&addr_err, &master, &err_addr);
	if( addr_err ){
		//Processing when illegal address access error occurs
	}

	//Clear the bus error status registers
	R_PG_ExtBus_ClearErrorFlags();
}
```

5.7.4 R_PG_ExtBus_ClearErrorFlags

Definition: bool R_PG_ExtBus_ClearErrorFlags(void)

Description: Clear the bus-error status registers

Parameter: None

Return value:

true	Clearing succeeded
false	Clearing failed

File for output: R_PG_ExtBus.c

RPDL function: R_BSC_Control

Details:

- Clears the bus-error status registers (illegal address access error flag, ID code of bus master and a value of accessed address).

Example: A case where BusErrFunc has been specified as the name of the bus error interrupt notification function.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set up the bus error monitoring.
	R_PG_ExtBus_SetBus();
}

//Bus error notification function
void BusErrFunc(void)
{
	bool addr_err;
	uint8_t master;
	uint16_t err_addr;

	//Aquire bus error status
	R_PG_ExtBus_GetErrorStatus(&addr_err, &master, &err_addr);
	if( addr_err ){
		//Processing when illegal address access error occurs
	}

	//Clear the bus error status registers
	R_PG_ExtBus_ClearErrorFlags();
}
```

5.8 DMA controller (DMACA)

5.8.1 R_PG_DMAC_Set_C<*channel number*>

Definition: bool R_PG_DMAC_Set_C<*channel number*> (void)
<*channel number*>: 0 to 3

Description: Set up a DMAC channel

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*unit number*>: 0 to 3

RPDL function: R_DMAC_Create

Details:

- Releases the DMAC from the module-stop and makes initial settings.
- If an interrupt was selected as a transfer start trigger, the DMAC channel will be ready for the interrupt signal by calling R_PG_DMAC_Activate_C<*channel number*> after calling this function. If the software trigger was selected as a transfer start trigger, DMAC channel will start the data transfer when calling R_PG_DMAC_StartTransfer_C<*channel number*> or R_PG_DMAC_StartContinuousTransfer_C<*channel number*> after calling this function.
- The DMAC interrupt is set by this function. When the name of the interrupt notification function has been specified in the GUI, if a CPU interrupt occurs, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of this chapter end, Notes on Notification Functions.
- To transfer the SCI transmission data by DMAC, make the following settings.
  DMAC settings

Transfer request source	: TXI1 (SCI1 transmit data empty interrupt)
Operation when the transfer completes	: Clear the interrupt flag of the activation source
Destination start address *Destination start address can be set also from the program. Refer the usage example 2 and 3.	: Address of Transmit Data Register (TDR)
Destination address update mode	: Fixed
Length of a single data	: 1 byte

SCIe setting

Data transmission method	: Transfer the transmitted serial data by DMAC

For usage of function, refer to example 2.

- To transfer the SCI reception data by DMAC, make the following settings.
  DMAC settings

Transfer request source	: RXI1 (SCI1 receive data full interrupt)
Operation when the transfer completes	: Clear the interrupt flag of the activation source
Source start address *Source start address can be set also from the program. Refer the usage example 2 and 3.	: Address of Receive Data Register (RDR)
Source address update mode	: Fixed
Length of a single data	: 1 byte

SCIe setting

Data transmission method	: Transfer the received serial data by DMAC

For usage of function, refer to example 3.

Example 1 A case where IRQ0 activates DMA transfer

- IRQ0 interrupt was selected as a transfer start trigger of DMAC0 in GUI.
- Dmac0IntFunc was specified as the DMA interrupt notification function name in the GUI.
- DMAC was selected as an interrupt request destination for IRQ0.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    R_PG_DMAC_Set_C0();    //Set up DMAC0

    R_PG_ExtInterrupt_Set_IRQ0();    //Set up IRQ0

    R_PG_DMAC_Activate_C0();    //Make DMAC0 be ready for the transfer start trigger
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    R_PG_DMAC_StopModule_C0();    //Stop DMAC
}
```

Example 2 A case where the SCI transmission data is transferred by DMAC

- Dmac0IntFunc was specified as the DMA interrupt notification function name in the GUI.
- The SCI1 transmit data empty interrupt is selected as a DMA transfer trigger.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

volatile bool sci_dma_transfer_complete;    //DMA transfer end flag
uint8_t tr[]=”ABCDEFG”;    //Data source

void func(void)
{
    //Initialize DMA transfer end flag
    sci_dma_transfer_complete = false;

    R_PG_Clock_Set();    //The clock-generation circuit has to be set first.

    R_PG_SCI_Set_C1();    //Set up SCI1

    R_PG_DMAC_Set_C0();    //Set up DMAC0

   //Set source address, destination address and transfer counter
   R_PG_DMAC_SetSrcAddress_C0( tr );
   R_PG_DMAC_SetDestAddress_C0((void*)&(SCI1.TDR));
   R_PG_DMAC_SetTransferCount_C0( 8 );

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Enable the SCI1 transmission (TXI interrupt occurs and DMA transfer starts)
    R_PG_SCI_SendAllData_C1(
        PDL_NO_PTR,
        PDL_NO_DATA
    );
    // Wait for the DMAC to complete the transfer
    while (sci_dma_transfer_complete == false);
}

//DMA interrupt notification function
```

```
void Dmac0IntFunc (void)
{
    //SCI transmit end flag
    bool sci_transfer_complete;
    sci_transfer_complete = false;

  // Wait for the SCI to complete the transmission
    do{
        R_PG_SCI_GetTransmitStatus_C1( &sci_transfer_complete );
    } while( ! sci_transfer_complete );

    //Stop the SCI
    R_PG_SCI_StopCommunication_C1();

    //Stop the DMAC
    R_PG_DMAC_StopModule_C0();

    sci_dma_transfer_complete = true;
}
```

Example 3 A case where the SCI reception data is transferred by DMAC

- Dmac0IntFunc was specified as the DMA interrupt notification function name in the GUI.
- The SCI1 receive data empty interrupt is selelcted as a DMA transfer trigger.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

volatile bool sci_dma_transfer_complete;    //DMA transfer end flag
uint8_t re[]=”--------”;    //Data destination

void func(void)
{
    //Initialize DMA transfer end flag
    sci_dma_transfer_complete = false;

    R_PG_SCI_Set_C1();    //Set up SCI1

    R_PG_DMAC_Set_C0();    //Set up DMAC0

   //Set source address, destination address and transfer counter
   R_PG_DMAC_SetSrcAddress_C0((void*)&(SCI1.RDR) );
   R_PG_DMAC_SetDestAddress_C0( re );
   R_PG_DMAC_SetTransferCount_C0( 8 );

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Enable the SCI1 reception
    R_PG_SCI_ReceiveAllData_C1(
        PDL_NO_PTR,
        PDL_NO_DATA
    );
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    //Stop the SCI reception
    R_PG_SCI_StopCommunication_C1();

  //Stop the DMAC
    R_PG_DMAC_StopModule_C0();
}
```

5.8.2 R_PG_DMAC_Activate_C<*channel number*>

Definition: bool R_PG_DMAC_Activate_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Make the DMAC be ready for the start trigger

Conditions for output: An interrupt is selected as a transfer start trigger

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details:

- This function makes the DMAC channel be ready for the transfer start trigger.
- This function is genetarted when an interrupt is selected as a transfer start trigger.
- Call R_PG_DMAC_Set_C<*channel number*> to set up a DMAC channel before calling this function.

Example: A case where the setting is made as follows.

- IRQ0 was selected as a transfer start trigger of DMAC0 in normal transfer mode
- Dmac0IntFunc was specified as the DMA0 interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Set IRQ0
    R_PG_ExtInterrupt_Set_IRQ0();

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    //Stop the DMAC
    R_PG_DMAC_StopModule_C0();
}
```

5.8.3 R_PG_DMAC_StartTransfer_C<*channel number*>

Definition: bool R_PG_DMAC_StartTransfer_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Start the one transfer of DMAC (Software trigger)

Conditions for output: The software trigger is selected as a transfer start trigger

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details:

- This function starts DMA transfer of the channel specified the software trigger as a transfer start trigger.
- A DMA transfer request is cleared automatically when data transfer is started.

Example: A case where the setting is made as follows.

- The software trigger was selected as a transfer start trigger of DMAC0 in normal transfer mode
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

volatile bool transferred;

void func(void)
{
	transferred = false;

	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	while( transferred == false ){
		//Start the DMA transfer of DMAC0
		R_PG_DMAC_StartTransfer_C0();
	}
	//Stop the DMAC
	R_PG_DMAC_StopModule_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	transferred = true;
}
```

5.8.4 R_PG_DMAC_StartContinuousTransfer_C<*channel number*>

Definition: bool R_PG_DMAC_StartContinuousTransfer_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Start the continuous transfer of DMAC (Software trigger)

Conditions for output: The software trigger is selected as a transfer start trigger

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details:
- This function starts DMA transfer of the channel specified the software trigger as a transfer start trigger.
- This function enables continuous DMA transfer because a DMA transfer request is generated again after completion of a transfer.

Example: A case where the setting is made as follows.
- The software trigger was selected as a transfer start trigger of DMAC0 in normal transfer mode
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
      //Set up DMAC0
      R_PG_DMAC_Set_C0();

      //Start the DMA transfer of DMAC0
      R_PG_DMAC_StartContinuousTransfer_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
      //Stop the DMAC
      R_PG_DMAC_StopModule_C0();
}
```

5.8.5 R_PG_DMAC_StopContinuousTransfer_C<*channel number*>

Definition: bool R_PG_DMAC_StopContinuousTransfer_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Stop the software-triggered continuous transfer of DMAC

Conditions for output: The software trigger is selected as a transfer start trigger

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details:
- This function clears DMA transfer request of the channel specified the software trigger as a transfer start trigger.

Example: A case where the setting is made as follows.
- The software trigger was selected as a transfer start trigger of DMAC0 in normal transfer mode

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func1(void)
{
    //Set up DMAC0
    R_PG_DMAC_Set_C0();
    //Start the DMA transfer of DMAC0
    R_PG_DMAC_StartContinuousTransfer_C0();
}
void func2(void)
{
    //Clear DMA transfer request by software
    R_PG_DMAC_StopContinuousTransfer_C0();
}
```

5.8.6 R_PG_DMAC_Suspend_C<*channel number*>

Definition: bool R_PG_DMAC_Suspend_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Suspend the data transfer

Parameter: None

Return value:

true	Suspending succeeded.
false	Suspending failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details:
- This function suspends(disables) the DMA transfer.
- This function can suspend the DMA transfer triggered by hardware.
- To resume the transfer, when interrupt is selected as a transfer start trigger, clear the interrupt request flag of trigger source and call R_PG_DMAC_Activate_C<*channel number*> to make the DMAC channel be ready for the transfer start trigger.

Example: A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0 in normal transfer mode
- Dmac0IntFunc was specified as the DMA interrupt notification function name
- Irq1IntFunc was specified as the IRQ1 interrupt notification function name
- Irq2IntFunc was specified as the IRQ2 interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    R_PG_DMAC_Set_C0();    //Set up DMAC0
    R_PG_ExtInterrupt_Set_IRQ0();    //Set IRQ0
    R_PG_ExtInterrupt_Set_IRQ1();    //Set IRQ1
    R_PG_ExtInterrupt_Set_IRQ2();    //Set IRQ2
    R_PG_DMAC_Activate_C0();    // Make DMAC0 be ready for the transfer start trigger
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    R_PG_DMAC_StopModule_C0();    //Stop the DMAC
}

//DMA transfer is suspended by IRQ1 input
void Irq1IntFunc (void)
{
    R_PG_DMAC_Suspend_C0();    //Suspend the DMA transfer
}

//DMA transfer is re-activated by IRQ2 input
void Irq2IntFunc (void)
{
    R_PG_ExtInterrupt_ClearRequestFlag_IRQ0();    //Clear the request flag of trigger
    R_PG_DMAC_Activate_C0();    // Make DMAC0 be ready for the transfer start trigger
}
```

5.8.7 R_PG_DMAC_GetTransferCount_C<*channel number*>

Definition

bool R_PG_DMAC_GetTransferCount_C<*channel number*> (uint16_t * count)
< *channel number* > : 0 to 3

Description

Get the transfer counter value

Parameter

uint16_t * count	The address of storage area for the counter value

Return value

true	Acquisition succeeded
false	Acquisition failed.

File for output

R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function

R_DMAC_GetStatus

Details

- This function gets the current transfer counter value.
- The DMA interrupt request flag (IR flag) is cleared in this function. Call R_PG_DMAC_ClearInterruptFlag_C<*channel number*> to get the DMA interrupt request flag before calling this function if needed.

Example

A case where the setting is made as follows.

- The transfer start trigger of DMAC0 is interrupt

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
      uint16_t count;

      //Set up DMAC0
      R_PG_DMAC_Set_C0();

      //Make DMAC0 be ready for the transfer start trigger
      R_PG_DMAC_Activate_C0();

      //Wait for the transfer counter to become lower than 10
      do{
            R_PG_DMAC_GetTransferCount_C0( & count );
      } while( count >= 10 );

      //Suspend the DMA transfer
      R_PG_DMAC_Suspend_C0();
}
```

5.8.8 R_PG_DMAC_SetTransferCount_C<*channel number*>

Definition

bool R_PG_DMAC_SetTransferCount_C<*channel number*>(uint16_t count)

< *channel number* > : 0 to 3

Description

Set the transfer counter

Parameter

uint16_t count	Value to be set to the transfer counter

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_DMAC_C<*channel number*>.c

<*channel number*>: 0 to 3

RPDL function

R_DMAC_Control

Details

- This function sets the transfer counter.
- The valid range of the counter value is from 0 to 65535 (0 : free running mode) in normal
- transfer mode, 0 to 1023 (0 = 1024 units) in repeat transfer mode and block transfer mode.

Example

A case where the setting is made as follows.

- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Set IRQ0
    R_PG_ExtInterrupt_Set_IRQ0();

    // Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();
}
//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    //Suspend the DMA transfer
    R_PG_DMAC_Suspend_C0();

    //Change the DMAC0 settings
    R_PG_DMAC_SetSrcAddress_C0( src_address );    //Source address
    R_PG_DMAC_SetDestAddress_C0( dest_address );    //Destination address
    R_PG_DMAC_SetTransferCount_C0( tr_count );    //Transfer counter

    // Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();
}
```

5.8.9 R_PG_DMAC_GetRepeatBlockSizeCount_C<*channel number*>

Definition: bool R_PG_DMAC_GetRepeatBlockSizeCount_C<*channel number*> (uint16_t * count)
< *channel number* > : 0 to 3

Description: Get the repeat/block size counter value

Conditions for output: Repeat transfer mode or block transfer mode is selected for the transfer mode.

Parameter:

uint16_t * count	The address of storage area for the counter value

Return value:

true	Acquisition succeeded
false	Acquisition failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_GetStatus

Details:
- This function gets the current repeat/block size counter value.
- The DMA interrupt request flag (IR flag) is cleared in this function. Call R_PG_DMAC_ClearInterruptFlag_C<*channel number*> to get the DMA interrupt request flag before calling this function if needed.

Example: A case where the setting is made as follows.
- DMAC0 is set to repeat transfer mode
- The transfer start trigger is interrupt

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
    uint16_t count;
    //Set up DMAC0
    R_PG_DMAC_Set_C0();
    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();
    //Wait for the repeat size counter to become lower than 10
    do{
        R_PG_DMAC_GetRepeatBlockSizeCount_C0( & count );
    } while( count >= 10 );
    //Suspend the DMA transfer
    R_PG_DMAC_Suspend_C0();
}
```

5.8.10 R_PG_DMAC_SetRepeatBlockSizeCount_C<*channel number*>

Definition

bool R_PG_DMAC_SetRepeatBlockSizeCount_C<*channel number*> (uint16_t count)
< *channel number* > : 0 to 3

Description

Set the repeat/block size counter value

Conditions for output

Repeat transfer mode or block transfer mode is selected for the transfer mode.

Parameter

uint16_t count	Value to be set to the repeat/block size counter

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function

R_DMAC_GetStatus

Details

- This function sets the repeat/block size counter.
  The valid range of the counter value is from 0 to 1023 (0 = 1024 units) in repeat transfer mode, 1 to 1023 in block transfer mode.

Example

A case where the setting is made as follows.

- DMAC0 is set to repeat transfer mode
- IRQ0 interrupt was selected as a transfer start trigger
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Change the DMAC0 settings
	R_PG_DMAC_SetTransferCount_C0( tr_count );	//Transfer counter
	R_PG_DMAC_SetRepeatBlockSizeCount_C0( repeat_count );	//Repeat size counter

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.11 R_PG_DMAC_ClearInterruptFlag_C<*channel number*>

Definition	bool R_PG_DMAC_ClearInterruptFlag_C<*channel number*> (bool * int_request) < *channel number* > : 0 to 3
Description	Get and clear the interrupt request flag
Conditions for output	DMA interrupt is enabled

Parameter

bool * int_request	The address of storage area for the interrupt request flag

Return value

true	Acquisition and clearing succeeded
false	Acquisition and clearing failed

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_GetStatus

Details
- This function gets and clears the DMA interrupt request flag (IR flag).

Example
A case where the setting is made as follows.
- DMAC0 is set to mormal transfer mode
- The transfer start trigger is interrupt
- The DMA interrupt is enabled
- The DMA interrupt priority level is 0

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    bool int_request;

    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Wait for the IR flag to become 1
    do{
        R_PG_DMAC_ClearInterruptFlag_C0(& int_request );
    } while( int_request == false );
}
```

5.8.12 R_PG_DMAC_GetTransferEndFlag_C<*channel number*>

Definition
bool R_PG_DMAC_GetTransferEndFlag_C<*channel number*> (bool* end)
< *channel number* > : 0 to 3

Description
Get the transfer end flag

Parameter

bool* end	The address of storage area for the transfer end flag

Return value

true	Acquisition succeeded
false	Acquisition failed.

File for output
R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function
R_DMAC_GetStatus

Details
- This function gets the transfer end flag.
- The DMA interrupt request flag (IR flag) is cleared in this function. Call R_PG_DMAC_ClearInterruptFlag_C<*channel number*> to get the DMA interrupt request flag before calling this function if needed.
- The transfer end flag is not cleared in this function. Call R_PG_DMAC_ClearTransferEndFlag_C<*channel number*> to clear the transfer end flag if needed.

Example
A case where the setting is made as follows.
- DMAC0 is set to normal transfer mode
- The transfer start trigger is interrupt
- The DMA interrupt is not enabled

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    bool end;

    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Wait for the transfer end flag to become 1
    do{
        R_PG_DMAC_GetTransferEndFlag_C0( & end );
    } while( end == false );

    //Clear the DMA transfer end flag
    R_PG_DMAC_ClearTransferEndFlag_C0();
}
```

5.8.13 R_PG_DMAC_ClearTransferEndFlag_C<*channel number*>

Definition

bool R_PG_DMAC_ClearTransferEndFlag_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description

Clear the transfer end flag

Parameter

None

Return value

true	Clearing succeeded
false	Clearing failed

File for output

R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function

R_DMAC_Control

Details

- This function clears the transfer end flag.
- To get the transfer end flag, call R_PG_DMAC_GetTransferEndFlag_C<*channel number*>.

Example

A case where the setting is made as follows.

- DMAC0 is set to mormal transfer mode
- The transfer start trigger is interrupt
- The DMA interrupt is not enabled

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    bool end;

    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Wait for the transfer end flag to become 1
    do{
        R_PG_DMAC_GetTransferEndFlag_C0( & end );
    } while( end == false );

    //Clear the DMA transfer end flag
    R_PG_DMAC_ClearTransferEndFlag_C0();
}
```

5.8.14 R_PG_DMAC_GetTransferEscapeEndFlag_C<*channel number*>

Definition: bool R_PG_DMAC_GetTransferEscapeEndFlag_C<*channel number*> (bool* end)
< *channel number* > : 0 to 3

Description: Get the transfer escape end flag

Conditions for output: [Completion of a 1-block/repeat size transfer], [Source address extended repeat area overflow] or [Destination address extended repeat area overflow] is selected as the interrupt output source

Parameter

bool* end	The address of storage area for the transfer escape end flag

Return value

true	Acquisition succeeded
false	Acquisition failed.

File for output: R_PG_DMAC_C <*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_GetStatus

Details
- This function gets the DMA transfer escape end flag (EDMSTS.ESIF).
- The DMA interrupt request flag (IR flag) is cleared in this function. Call R_PG_DMAC_ClearInterruptFlag_C<*channel number*> to get the DMA interrupt request flag before calling this function if needed.
- The transfer escape end flag is not cleared in this function. Call R_PG_DMAC_ClearTransferEscapeEndFlag_C<*channel number*> to clear the transfer escape end flag if needed.

Example: A case where the setting is made as follows.
- DMAC0 is set to repeat transfer mode
- The transfer start trigger is interrupt
- [Completion of a 1-block/repeat size transfer] is selected for the interrupt output source
- The DMA interrupt priority level is 0

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    bool end;

    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Make DMAC0 be ready for the transfer start trigger
    R_PG_DMAC_Activate_C0();

    //Wait for the transfer escape end flag to become 1
    do{
        R_PG_DMAC_GetTransferEscapeEndFlag_C0( & end );
    } while( end == false );

    //Clear the DMA transfer escape end flag
    R_PG_DMAC_ClearTransferEscapeEndFlag_C0();
}
```

5.8.15 R_PG_DMAC_ClearTransferEscapeEndFlag_C<*channel number*>

Definition	bool R_PG_DMAC_ClearTransferEscapeEndFlag_C<*channel number*> (void) < *channel number* > : 0 to 3
Description	Clear the transfer escape end flag
Conditions for output	[Completion of a 1-block/repeat size transfer], [Source address extended repeat area overflow] or [Destination address extended repeat area overflow] is selected as the interrupt output source
Parameter	None

Return value

true	Clearing succeeded
false	Clearing failed

File for output	R_PG_DMAC_C <*channel number*>.c <*channel number*>: 0 to 3
RPDL function	R_DMAC_Control

Details

- This function clears the transfer escape end flag.
- To get the transfer escape end flag, call R_PG_DMAC_GetTransferEscapeEndFlag_C<*channel number*>.

Example

A case where the setting is made as follows.

- DMAC0 is set to repeat transfer mode
- The transfer start trigger is interrupt
- [Completion of a 1-block/repeat size transfer] is selected for the interrupt output source
- The DMA interrupt priority level is 0

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	bool end;

	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();

	//Wait for the transfer escape end flag to become 1
	do{
		R_PG_DMAC_GetTransferEscapeEndFlag_C0( & end );
	} while( end == false );

	//Clear the DMA transfer escape end flag
	R_PG_DMAC_ClearTransferEscapeEndFlag_C0();
}
```

5.8.16 R_PG_DMAC_SetSrcAddress_C<*channel number*>

Definition: bool R_PG_DMAC_SetSrcAddress_C<*channel number*>(void * src_addr)
< *channel number* > : 0 to 3

Description: Set the source address

Parameter

void * src_addr	The source address to be set

Return value

true	Setting was made correctly
false	Setting failed.

File for output: R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details
- This function sets the source address.

Example
A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Change the DMAC0 settings
	R_PG_DMAC_SetSrcAddress_C0( src_address );	//Source address
	R_PG_DMAC_SetDestAddress_C0( dest_address );	//Destination address
	R_PG_DMAC_SetTransferCount_C0( tr_count );	//Transfer counter

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.17 R_PG_DMAC_SetDestAddress_C<*channel number*>

Definition
: bool R_PG_DMAC_SetDestAddress_C<*channel number*>(void * dest_addr)
< *channel number* > : 0 to 3

Description
: Set the source address

Parameter

void * dest_addr	The destination address to be set

Return value

true	Setting was made correctly
false	Setting failed.

File for output
: R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function
: R_DMAC_Control

Details
- This function sets the destination address.

Example
A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Set up the DMAC and continue
	R_PG_DMAC_SetSrcAddress_C0( src_address );    //Source address
	R_PG_DMAC_SetDestAddress_C0( dest_address );    //Destination address
	R_PG_DMAC_SetTransferCount_C0( tr_count );    //Transfer counter

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.18 R_PG_DMAC_SetAddressOffset_C<*channel number*>

Definition	bool R_PG_DMAC_SetAddressOffset_C<*channel number*>(int32_t offset) < *channel number* > : 0 to 3
Description	Set the address offset
Conditions for output	[Offset addition] is selected for [Source address update mode] or [Destination address update mode].

Parameter

int32_t offset	The offset value to be set

Return value

true	Setting was made correctly
false	Setting failed

File for output: R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Control

Details
- This function sets the address offset.
- The range of the address offset value is from +FFFFFFh to -1000000h.

Example

A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name
- [Offset addition] is selected.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Set up the DMAC and continue
	R_PG_DMAC_SetSrcAddress_C0( src_address );	//Source address
	R_PG_DMAC_SetDestAddress_C0( dest_address );	//Destination address
	R_PG_DMAC_SetTransferCount_C0( tr_count );	//Transfer counter
	R_PG_DMAC_SetAddressOffset_C0( offset );	//Address offset

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.19 R_PG_DMAC_SetExtendedRepeatSrc_C<*channel number*>

Definition
bool R_PG_DMAC_SetExtendedRepeatSrc_C<*channel number*>(uint32_t area)
< *channel number* > : 0 to 3

Description
Set the source address extended repeat value

Conditions for output
An extended repeat area is specified for the transfer source.

Parameter

uint32_t area	The source address extended repeat value to be set

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function
R_DMAC_Control

Details
- This function sets the source address extended repeat value.
- The value can be any power of 2, from 2^1 to 2^{27}.

Example
A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name
- An extended repeat area is specified for the transfer source and destination.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Change the DMAC0 settings
	R_PG_DMAC_SetSrcAddress_C0( src_address );	//Source address
	R_PG_DMAC_SetDestAddress_C0( dest_address );	//Destination address
	R_PG_DMAC_SetTransferCount_C0( tr_count );	//Transfer counter
	R_PG_DMAC_SetExtendedRepeatSrc_C0( src_repeat );	//Source extended repeat size
	R_PG_DMAC_SetExtendedRepeatDest_C0( dest_repeat ); //Destination extended repeat size

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.20 R_PG_DMAC_SetExtendedRepeatDest_C<*channel number*>

Definition
bool R_PG_DMAC_SetExtendedRepeatDest_C<*channel number*>(uint32_t area)
< *channel number* > : 0 to 3

Description
Set the destination address extended repeat value

Conditions for output
An extended repeat area is specified for the transfer destination.

Parameter

uint32_t area	The destination address extended repeat value to be set

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function
R_DMAC_Control

Details
- This function sets the destination address extended repeat value.
- The value can be any power of 2, from 2^1 to 2^{27}.

Example
A case where the setting is made as follows.
- IRQ0 interrupt was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name
- An extended repeat area is specified for the transfer source and destination.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func(void)
{
	//Set up DMAC0
	R_PG_DMAC_Set_C0();

	//Set IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
//DMA interrupt notification function
void Dmac0IntFunc (void)
{
	//Suspend the DMA transfer
	R_PG_DMAC_Suspend_C0();

	//Change the DMAC0 settings
	R_PG_DMAC_SetSrcAddress_C0( src_address );	//Source address
	R_PG_DMAC_SetDestAddress_C0( dest_address );	//Destination address
	R_PG_DMAC_SetTransferCount_C0( tr_count );	//Transfer counter
	R_PG_DMAC_SetExtendedRepeatSrc_C0( src_repeat );	//Source extended repeat size
	R_PG_DMAC_SetExtendedRepeatDest_C0( dest_repeat );	//Destination extended repeat size

	// Make DMAC0 be ready for the transfer start trigger
	R_PG_DMAC_Activate_C0();
}
```

5.8.21 R_PG_DMAC_StopModule_C<*channel number*>

Definition: bool R_PG_DMAC_StopModule_C<*channel number*> (void)
< *channel number* > : 0 to 3

Description: Stop the DMAC channel

Parameter: None

Return value:

true	Stopping succeeded.
false	Stopping failed.

File for output: R_PG_DMAC_C<*channel number*>.c
<*channel number*>: 0 to 3

RPDL function: R_DMAC_Destroy

Details:
- Stops the DMAC channel.
- If all DMAC channels and DTC are stopped, DMAC and DTC shall be module-stop state.
- If another peripheral is being used to trigger a DMA transfer, stop the trigger sources before calling this function.

Example: A case where the setting is made as follows.
- The software trigger was selected as a transfer start trigger of DMAC0
- Dmac0IntFunc was specified as the DMA interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
    //Set up DMAC0
    R_PG_DMAC_Set_C0();

    //Start the DMA transfer of DMAC0
    R_PG_DMAC_StartTransfer_C0();
}

//DMA interrupt notification function
void Dmac0IntFunc (void)
{
    //Stop the DMAC0
    R_PG_DMAC_StopModule_C0();
}
```

5.9 Data Transfer Controller (DTCa)

5.9.1 R_PG_DTC_Set

Definition bool R_PG_DTC_Set (void)

Description Set the common options for DTC

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_DTC.c

RPDL function R_DTC_Set

Details
- Releases DTC and DMAC from the module-stop state.
- Before calling other functions of DTC, call this function.
- This function configures the read skip control, address mode and the DTC vector table base address.

Example A case where the setting is made as follows.
- The DTC vector table address has been set to 2000h.
- The transfer setting of which the transfer start trigger is IRQ0 has been made.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

//DTC vector table
#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];

//Set up the DTC
void func(void)
{
	// Set the common options for DTC
	R_PG_DTC_Set();

	//Make the transfer setting of which the transfer start trigger is IRQ0
	R_PG_DTC_Set_IRQ0();

	//Make DTC be ready for the transfer start trigger
	R_PG_DTC_Activate();

	//Set up IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();
}
```

5.9.2 R_PG_DTC_Set_<*trigger source*>

Definition

bool R_PG_DTC_Set_<*trigger source*> (void)

< *trigger source* >

SWINT	Software interrupt
CMI0 to 3	CMT0 to 3 compare match interrupt
SPRI0	RSPI0 receive interrupt
SPTI0	RSPI0 transmit interrupt
IRQ0 to 7	External interrupts
S12ADI0	A/D scan end interrupt
GBADI	Group B scan end interrupt
ELSR18I	ELC interrupt
TGIA0 to D0	MTU0 input capture/compare match A to D interrupt
TGIA1 or B1	MTU1 input capture/compare match A or B interrupt
TGIA2 or B2	MTU2 input capture/compare match A or B interrupt
TGIA3 to D3	MTU3 input capture/compare match A to D interrupt
TGIA4 to D4	MTU4 input capture/compare match A to D interrupt
TCIV4	MTU4 overflow/underflow interrupt
TGIU5 to W5	MTU5 input capture/compare match U to W interrupt
CMIA0 or B0	TMR0 compare match A or B interrupt
CMIA1 or B1	TMR1 compare match A or B interrupt
CMIA2 or B2	TMR2 compare match A or B interrupt
CMIA3 or B3	TMR3 compare match A or B interrupt
DMAC0I to 3I	DMACA0 to 3 interrupt
RXI1, 5, 6, 9 and 12	SCI1, 5, 6, 9, 12 receive data full interrupt
TXI1, 5, 6, 9 and 12	SCI1, 5, 6, 9, 12 transmit data empty interrupt
ICRXI0	RIIC0 receive data full interrupt
ICTXI0	RIIC0 transmit data empty interrupt

Description

Set the DTC transfer data

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_DTC.c

RPDL function

R_DTC_Create

Details

- Store the transfer data that will be triggered by transfer start trigger in specified address.
- The transfer data of the chain transfer will also be stored.
- If other transfer data has already been stored in the specified address, new data will be overwritten.
- This function does not set any interrupts used for transfer start triggers. Set up interrupts

by each peripheral function.

- Select DTC as the request destination of interrupts used for the transfer start trigger.
- Call this function before configuring the peripherals that will be involved in the data transfer.

Example   A case where the setting is made as follows.

- The DTC vector table address has been set to 2000h.
- The transfer setting of which the transfer start trigger is IRQ0 has been made.
- The transfer setting of which the transfer start trigger is IRQ1 has been made.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];    //DTC vector table

//Set up the DTC
void func(void)
{
        // Set the common options for DTC
        R_PG_DTC_Set();

        //Make the transfer setting of which the transfer start trigger is IRQ
        R_PG_DTC_Set_IRQ0();
        R_PG_DTC_Set_IRQ1();

        //Make DTC be ready for the transfer start trigger
        R_PG_DTC_Activate();

        //Set up IRQ0 and IRQ1
        R_PG_ExtInterrupt_Set_IRQ0();
        R_PG_ExtInterrupt_Set_IRQ1();
}
```

5.9.3 R_PG_DTC_Activate

Definition bool R_PG_DTC_Activate (void)

Description Make the DTC be ready for the transfer start trigger

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_DTC.c

RPDL function R_DTC_Control

Details
- Makes the DTC be ready for the transfer start trigger.
- Call R_PG_DTC_Set_<*trigger source*> to store the transfer data before calling this function.

Example A case where the setting is made as follows.
- The DTC vector table address has been set to 2000h.
- The transfer setting of which the transfer start trigger is IRQ0 has been made.
- “Request is transferred to CPU when specified transfer is completed” has been selected in the interrupt setting.
- The chain transfer has been disabled.
- Irq0IntFunc has been specified as an IRQ0 interrupt notification function name.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

//DTC vector table
#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];

//Set up the DTC
void func(void)
{
    // Set the common options for DTC
    R_PG_DTC_Set();

    //Make the transfer setting of which the transfer start trigger is IRQ0
    R_PG_DTC_Set_IRQ0();

    //Make DTC be ready for the transfer start trigger
    R_PG_DTC_Activate();

}

void Irq0IntFunc(void)
{
    //Disable the IRQ0
    //(After specified number of transfer completes, transfer will be executed
    // when the trigger is input. To stop the data transfer, disable the interrupt.)
    R_PG_ExtInterrupt_Disable_IRQ0();
}
```

5.9.4 R_PG_DTC_SuspendTransfer

Definition: bool R_PG_DTC_SuspendTransfer (void)

Description: Stop the data transfer

Parameter: None

Return value:

true	Stopping succeeded
false	Stopping failed

File for output: R_PG_DTC.c

RPDL function: R_DTC_Control

Details:
- Stops the data transfer.
- If transfer is stopped during data transfer, the accepted start request is active until the processing is completed.
- Call R_DTC_Activate to enable the transfer.

Example: A case where the setting is made as follows.
- The DTC vector table address has been set to 2000h.
- The transfer setting of which the transfer start trigger is IRQ0 has been made.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

//DTC vector table
#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];

//Set up the DTC
void func(void)
{
	// Set the common options for DTC
	R_PG_DTC_Set();

	//Make the transfer setting of which the transfer start trigger is IRQ0
	R_PG_DTC_Set_IRQ0();

	//Make DTC be ready for the transfer start trigger
	R_PG_DTC_Activate();

	//Set up IRQ0
	R_PG_ExtInterrupt_Set_IRQ0();
}

//Suspend the DTC transfer
void func2(void)
{
	R_PG_DTC_SuspendTransfer();
}

//Resume the DTC transfer
void func3(void)
{
	R_PG_DTC_Activate();
}
```

5.9.5 R_PG_DTC_GetTransmitStatus

Definition bool R_PG_DTC_GetTransmitStatus (uint8_t * vector, bool * active)

Description Get transfer status

Parameter

uint8_t * vector	The address of storage area for the vector number of current data transfer (Valid when “* active” is 1)
bool * active	The address of storage area for the progress flag. If this value is 1, the data transfer is processed.

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_DTC.c

RPDL function R_DTC_GetStatus

Details

- This function acquires the active flag and the vector number of the current data transfer.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t vector;
bool active;

void func(void)
{
	//Get the DTC transfer status
	R_PG_DTC_GetTransmitStatus ( &vector, &active);

	if(active){
		switch( vector ){
			case 64:
				//Processing when the transfer of vector 64 is in progress
				break;
			case 65:
				//Processing when the transfer of vector 65 is in progress
				break;
			default:
		}
	}
}
```

5.9.6 R_PG_DTC_StopModule

Definition: bool R_PG_DTC_StopModule (void)

Description: Shut down the DTC

Parameter: None

Return value:

true	Shutting down succeeded
false	Shutting down failed

File for output: R_PG_DTC.c

RPDL function: R_DTC_Destroy

Details:

- This function shuts down the DTC and places it in the module-stop state.
- Disable the interrupt used for transfer start trigger before calling this function.
- This function will also shut down the DMAC.

Example: A case where the setting is made as follows.

- The DTC vector table address has been set to 2000h.
- The transfer setting of which the transfer start trigger is IRQ0 has been made.
- The transfer setting of which the transfer start trigger is IRQ1 has been made.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

//DTC vector table
#pragma address dtc_vector_table = 0x00002000
uint32_t dtc_vector_table [256];

void func(void)
{
    // Set the common options for DTC
    R_PG_DTC_Set();

    //Make the transfer setting of which the transfer start trigger is IRQ0
    R_PG_DTC_Set_IRQ0();

    //Make the transfer setting of which the transfer start trigger is IRQ1
    R_PG_DTC_Set_IRQ1();

    //Make DTC be ready for the transfer start trigger
    R_PG_DTC_Activate();

    //Set up IRQ0 and IRQ1
    R_PG_ExtInterrupt_Set_IRQ0();
    R_PG_ExtInterrupt_Set_IRQ1();
}

void func2(void)
{
    //Disable IRQ0 and IRQ1
    R_PG_ExtInterrupt_Disable_IRQ0();
    R_PG_ExtInterrupt_Disable_IRQ1();
    //Shut down the DTC
    R_PG_DTC_StopModule();
}
```

5.10 Event Link Controller (ELC)

5.10.1 R_PG_ELC_Set

Definition: bool R_PG_ELC_Set (void)

Description: Sets the ELC

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_ELC.c

RPDL function: R_ELC_Create

Details:
- Releases the ELC from the module-stop state.
- After an event link with interrupt 1 has been set and an interrupt notification function has been specified, that function is called in response to the generation of an interrupt request for the CPU. The interrupt notification function must be in the following format:
  void <name of the interrupt notification function> (void)
  For notes on interrupt notification functions, refer to “Notes on Notification Functions” provided at the end of this section.
- This function must be called before any other ELC functions.

Example: The following settings have been made through the GUI.

- Set an event link with interrupt 1.
- Specify Elc1IntFunc as the interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    // Set up the event link controller (ELC).
    R_PG_ELC_Set();

    // Set an event link.
    R_PG_ELC_SetLink_Interrupt1();

    // Enable all event links.
    R_PG_ELC_AllEventLinkEnable();
}

// Interrupt notification function
void Elc1IntFunc(void)
{
    // Interrupt handling

    // Disable the event link.
    R_PG_ELC_DisableLink_Interrupt1();
}
```

5.10.2 R_PG_ELC_SetLink_<*peripheral module*>

Definition

bool R_PG_ELC_SetLink_<*peripheral module*> (void)

<*peripheral module*>

MTU1 to 4	Multi-function timer pulse unit 2 (MTU2a) channel 1 to 4
TMR0 or 2	8-bit timer (TMR) channel 0 or 2
ADC12	12-bit A/D converter (S12ADb)
Interrupt1	Interrupt 1
Output_Group1	Output port group 1
Input_Group1	Input port group 1
SinglePort0 or 1	Single port 0 or 1

Description

Sets an event link

Conditions for output

When a module to receive an event is specified, functions for that module are generated.

Parameter

None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output

R_PG_ELC.c

RPDL function

R_ELC_Control

Details

- Sets a link between an event and the module receiving the event signal.
- Specifies the action to be taken by the module on receiving the event signal.
- Call R_PG_ELC_AllEventLinkEnable to enable the event links.
- If you have selected the count start/event counter as [Operation when event is input] for TMR0/TMR2, call this function and then R_PG_Timer_Start_TMR_U<*unit number*>_C<*channel number*> before enabling the event links that have been set.

Example

Refer to the example of R_PG_ELC_Set.

5.10.3 R_PG_ELC_DisableLink_<*peripheral module*>

Definition

bool R_PG_ELC_DisableLink_<*peripheral module*> (void)

<*peripheral module*>

MTU1 to 4	Multi-function timer pulse unit 2 (MTU2a) channel 1 to 4
TMR0 or 2	8-bit timer (TMR) channel 0 or 2
ADC12	12-bit A/D converter (S12ADb)
Interrupt1	Interrupt 1
Output_Group1	Output port group 1
Input_Group1	Input port group 1
SinglePort0 or 1	Single port 0 or 1

Description

Disables an event link

Conditions for output

When a module to receive an event is specified, functions for that module are generated.

Parameter

None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output

R_PG_ELC.c

RPDL function

R_ELC_Control

Details

- Disables an event link that has been set.

Example

Refer to the example of R_PG_ELC_Set.

5.10.4 R_PG_ELC_Set_PortGroup<*port group number*>

Definition: bool R_PG_ELC_Set_PortGroup<*port group number*> (void)
<*port group number*>: 1

Description: Sets a port group

Conditions for output: Any of the bits having been selected for [Include in port group] under [Output port group and Input port group].

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_ELC.c

RPDL function: R_ELC_Control

Details:
- The bits selected through the GUI will compose port group 1 (port B).
  Sets event conditions for the port group.
-

Example: The following settings have been made through the GUI.
- PB0 to PB3 are selected for input during the process of setting I/O ports.
- The following item is selected as the event signal for input port group 1:
  [Software event signal]
- The following item is selected as the action to be taken on input of the event signal for input port group 1:
  [Transfer the signal value of the external pin to PDBFn]
- Input port group 1 includes the following bits:
  [PB0 to PB3]

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t pdbf1_val;   // Destination for storage of the value of port buffer register 1

void func1(void)
{
    R_PG_IO_PORT_Set_PB0();   // Set an I/O port pin (PB0).
    R_PG_IO_PORT_Set_PB1();   // Set an I/O port pin (PB1).
    R_PG_IO_PORT_Set_PB2();   // Set an I/O port pin (PB2).
    R_PG_IO_PORT_Set_PB3();   // Set an I/O port pin (PB3).

    R_PG_ELC_Set();   // Set up the event link controller (ELC).
    R_PG_ELC_SetLink_Input_Group1();   // Set an event link.
    R_PG_ELC_Set_PortGroup1();   // Set the port group.
    R_PG_ELC_AllEventLinkEnable();   // Enable all event links.
    R_PG_ELC_Generate_SoftwareEvent();   // Generate a software event.
}

void func2(void)
{
    R_PG_ELC_GetPortBufferValue_Group1(&pdbf1_val); // Acquire the value of the
                                                     // port buffer register.
    R_PG_ELC_StopModule();   // Stop the ELC
}
```

5.10.5 R_PG_ELC_Set_SinglePort<*single-port number*>

Definition: bool R_PG_ELC_Set_SinglePort<*single-port number*> (void)
<*single-port number*>: 0 or 1

Description: Sets a single-port pin

Conditions for output: The single-port setting satisfies the following conditions:
1. Any of port pins 0 or 1 is selected during the process of setting port pins.
2. Event conditions can be selected.

Note: This function is not usable when the port pins have been selected for output.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_ELC.c

RPDL function: R_ELC_Control

Details:
- This function specifies the bit selected through the GUI as a single-port pin.
- This function sets the event condition for the single-port pin.
- This function is only usable when the port pins have been selected for input.

Example: The following settings have been made through the GUI.

- PB0 is selected for input during the process of setting I/O port pins.
- The following item is selected as the event signal for interrupt 1:
  [Input edge detection signal of single input port 0]
- [CPU or CPU (After activating DMAC)] is selected as the action to be taken on input of the event signal for interrupt 1.
- [PB0] is selected as [Port settings] for single port pin 0.
  [Detect the falling edge] is selected as [Event generation condition] for single port pin 0.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
uint8_t elc1int_count=0;   // Number of times interrupts are generated

void func(void)
{
    R_PG_IO_PORT_Set_PB0();   // Set individual I/O port pins.
    R_PG_ELC_Set();   // Set up the event link controller (ELC).
    R_PG_ELC_SetLink_Interrupt1();   // Set an event link.
    R_PG_ELC_Set_SinglePort0();   // Set the single-port pin.
    R_PG_ELC_AllEventLinkEnable();   // Enable all event links.
}

// Interrupt notification function
void Elc1IntFunc(void)
{
    elc1int_count++;
}
```

5.10.6 R_PG_ELC_AllEventLinkEnable

Definition bool R_PG_ELC_AllEventLinkEnable (void)

Description Enables all event links

Conditions for output None

Return value

true	All event links were successfully enabled.
false	Enabling of all event links failed.

File for output R_PG_ELC.c

RPDL function R_ELC_Control

Details

- This function enables all event links that have been made.

Example Refer to the example of R_PG_ELC_Set.

5.10.7 R_PG_ELC_AllEventLinkDisable

Definition bool R_PG_ELC_AllEventLinkDisable (void)

Description Disables all event links

Parameter None

Return value

true	All event links were successfully disabled.
false	Disabling of all event links failed.

File for output R_PG_ELC.c

RPDL function R_ELC_Control

Details

- This function disables all event links that have been made.

Example Refer to the example of R_PG_ELC_Set_SinglePort<*single-port number*>.

5.10.8 R_PG_ELC_Generate_SoftwareEvent

Definition bool R_PG_ELC_Generate_SoftwareEvent (void)

Description Generates a software event

Conditions for output A software event signal is selected as the event signal.

Parameter None

Return value

true	A software event was successfully generated.
false	Generation of a software event signal failed.

File for output R_PG_ELC.c

RPDL function R_ELC_Control

Details

- This function generates a software event.

Example Refer to the example of R_PG_ELC_Set.

5.10.9 R_PG_ELC_GetPortBufferValue_Group<*port-group number*>

Definition

bool R_PG_ELC_GetPortBufferValue_Group<*port-group number*> (uint8_t * reg_val)
<*port-group number*>: 1

Description

Acquires the value of a port buffer register

Conditions for output

Any of the bits having been selected for [Include in port group] under [Output port group n and Input port group n].
n: 1

Parameter

uint8_t * reg_val	Destination for storage of the value of the port buffer register

Return value

true	The value was successfully acquired.
false	Acquisition failed.

File for output

R_PG_ELC.c

RPDL function

R_ELC_Read

Details

- This function acquires the value of the port buffer register.
  When <*port-group number*> is 1:
  The value of PDBF1 (port buffer register 1) is acquired.

Example

Refer to the example of R_PG_ELC_Set_PortGroup<*port-group number*>.

5.10.10 R_PG_ELC_SetPortBufferValue_Group<*port-group number*>

Definition	bool R_PG_ELC_SetPortBufferValue_Group<*port-group number*> (uint8_t reg_val) <*port-group number*>: 1
Description	Sets a value for a port buffer register
Conditions for output	Any of the bits having been selected for [Include in port group] under [Output port group n and Input port group n]. n: 1

Parameter

uint8_t reg_val	Value to be set for the port buffer register

Return value

True	Setting was made correctly.
False	Setting failed.

File for output: R_PG_ELC.c

RPDL function: R_ELC_Write

Details

- This function sets a value for the port buffer register.
  When <*port-group number*> is 1:
  The value is set in PDBF1 (port buffer register 1).

Example

The following settings have been made through the GUI.

- PB4 to PB7 are selected for output during the process of setting I/O ports.
- The following item is selected as an event signal for output port group 1:
  [Software event signal]
- The following item is selected as an action to be taken on input of the event signal for output port group 1:
  [Output the buffer value]
- Output port group 1 includes the following bits:
  [PB4 to PB7]

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    uint8_t pdbf1_val = 0xf0;   // The value to be set for port buffer register 1

    R_PG_IO_PORT_Set_PB4();   // Set an I/O port pin (PB4).
    R_PG_IO_PORT_Set_PB5();   // Set an I/O port pin (PB5).
    R_PG_IO_PORT_Set_PB6();   // Set an I/O port pin (PB6).
    R_PG_IO_PORT_Set_PB7();   // Set an I/O port pin (PB7).

    R_PG_ELC_Set();   // Set up the event link controller (ELC).
    R_PG_ELC_SetLink_Output_Group1();   // Set an event link.
    R_PG_ELC_Set_PortGroup1();   // Set the port group.
    R_PG_ELC_SetPortBufferValue_Group1(pdbf1_val); // Set the value for the port
                                                    // buffer register.
    R_PG_ELC_AllEventLinkEnable();   // Enable all event links.
    R_PG_ELC_Generate_SoftwareEvent();   // Generate a software event.
}
```

5.10.11 R_PG_ELC_StopModule

Definition bool R_PG_ELC_StopModule (void)

Description Stops the ELC

Parameter None

Return value

true	The ELC was successfully stopped.
false	Stopping the ELC failed.

File for output R_PG_ELC.c

RPDL function R_ELC_Destroy

Details
- This function disables all event links and places the ELC in the module-stop state.

Example Refer to the example of R_PG_ELC_Set_PortGroup<*port-group number*>.

5.11 I/O Ports

5.11.1 R_PG_IO_PORT_Set_P<*port number*>

Definition: bool R_PG_IO_PORT_Set_P<*port number*> (void)
<*port number*>: 0 to 5, A to E, H and J

Description: Set up the I/O port

Conditions for output: When [Used as an I/O port] of one or more pins are specified in the port in the GUI. However, when only P35 is specified in the PORT3, R_PG_IO_PORT_Set_P3 is not generated.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_IO_PORT_P<*port number*>.c
<*port number*>: 0 to 5, A to E, H and J

RPDL function: R_IO_PORT_Set

Details:
- Selects the direction (input or output), input pull-up resistor, output type, and drive capacity for pins for which [Used as an I/O port] was specified in the GUI.
- This function is used to set all pins for which [Used as I/O port] has been selected in a port.
- When set as an output port (high-drive output), all bits change to normal outputs when entering deep software standby.

Example:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Handle unavailable pins
	R_PG_IO_PORT_SetPortNotAvailable();

	//Set P0.
	R_PG_IO_PORT_Set_P0();
}
```

5.11.2 R_PG_IO_PORT_Set_P*<port number><pin number>*

Definition
bool R_PG_IO_PORT_Set_P<*port number*><*pin number*> (void)
<*port number*>: 0 to 5, A to E, H and J
<*pin number*>: 0 to 7

Description
Set up the I/O port pin

Conditions for output
When [Used as an I/O port] is specified in the GUI.
However, R_PG_IO_PORT_Set_P35 is not generated.

Parameter
None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_IO_PORT_P<*port number*>.c
<*port number*>: 0 to 5, A to E, H and J

RPDL function
R_IO_PORT_Set

Details
- Selects the direction (input or output), input pull-up resistor, output type, and drive capacity for pins for which [Used as an I/O port] was specified in the GUI.
- The setting only applies to one pin.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set P03.
	R_PG_IO_PORT_Set_P03();

	//Set P05.
	R_PG_IO_PORT_Set_P05();
}
```

5.11.3 R_PG_IO_PORT_Read_P<*port number*>

Definition: bool R_PG_IO_PORT_Read_P<*port number*> (uint8_t * data)
<*port number*>: 0 to 5, A to E, H and J

Description: Read data from Port Input Register

Conditions for output: When [Used as an I/O port] of one or more pins are specified in the port in the GUI.

Parameter:

uint8_t * data	Destination for storage of the read pin state

Return value:

true	Reading proceeded correctly.
false	Reading failed.

File for output: R_PG_IO_PORT_P<*port number*>.c
<*port number*>: 0 to 5, A to E, H and J

RPDL function: R_IO_PORT_Read

Details:
- Reads Port Input Register to acquire the states of the pins. (Unit: Port)

Example:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data;

void func(void)
{
    //Acquire the states of P0 pins.
    R_PG_IO_PORT_Read_P0( &data );
}
```

5.11.4 R_PG_IO_PORT_Read_P<*port number*><*pin number*>

Definition

bool R_PG_IO_PORT_Read_P<*port number*><*pin number*> (uint8_t * data)
<*port number*>: 0 to 5, A to E, H and J
<*pin number*>: 0 to 7

Description

Read 1-bit data from Port Input Register

Conditions for output

When [Used as an I/O port] of one or more pins are specified in the port in the GUI, the function of all existing pins in the port is generated.

Parameter

uint8_t * data	Destination for storage of the read pin state

Return value

true	Reading proceeded correctly.
false	Reading failed.

File for output

R_PG_IO_PORT_P<*port number*>.c
(<*port number*>: 0 to 5, A to E, H and J)

RPDL function

R_IO_PORT_Read

Details

- Reads Port Input Register to acquire the state of one pin.
- The value is stored in the lowest-order bit of *data.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_p03, data_p05;

void func(void)
{
	//Acquire the state of pin P03.
	R_PG_IO_PORT_Read_P03( & data_p03);

	//Acquire the state of pin P05.
	R_PG_IO_PORT_Read_P05( & data_p05);
}
```

5.11.5 R_PG_IO_PORT_Write_P<*port number*>

Definition: bool R_PG_IO_PORT_Write_P<*port number*> (uint8_t data)
<*port number*>: 0 to 5, A to E, H and J

Description: Write data to Port Output Data Register

Conditions for output: When [Used as an I/O port] of one or more pins are specified in the port in the GUI. However, when only P35 is specified in the PORT3, R_PG_IO_PORT_Write_P3 is not generated.

Parameter:

uint8_t data	Value to be written

Return value:

true	Writing proceeded correctly.
false	Writing failed.

File for output: R_PG_IO_PORT_P<*port number*>.c
<*port number*>: 0 to 5, A to E, H and J

RPDL function: R_IO_PORT_Write

Details:

- Writes a value to Port Output Data Register. A value written to the register is output from the output port.

Example:

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
        //Set P0.
        R_PG_IO_PORT_Set_P0();

        //Output 0x28 from P0.
        R_PG_IO_PORT_Write_P0( 0x28 );
}
```

5.11.6 R_PG_IO_PORT_Write_P*<port number><pin number>*

Definition

bool R_PG_IO_PORT_Write_P*<port number><pin number>* (uint8_t data)
<port number>: 0 to 5, A to E, H and J
<pin number>: 0 to 7

Description

Write 1-bit data to Port Output Data Register

Conditions for output

When [Used as an I/O port] is specified in the GUI.
However, R_PG_IO_PORT_Write_P35 is not generated.

Parameter

uint8_t data	Value to be written

Return value

true	Writing proceeded correctly.
false	Writing failed.

File for output

R_PG_IO_PORT_P*<port number>*.c
<port number>: 0 to 5, A to E, H and J

RPDL function

R_IO_PORT_Write

Details

- Writes a value to Port Output Data Register. A value written to an output port is output. Store the value in the lowest-order bit of data.

Example

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set P03.
	R_PG_IO_PORT_Set_P03();

	//Set P05.
	R_PG_IO_PORT_Set_P05();

	//Output low level from P03.
	R_PG_IO_PORT_Write_P03( 0x00 );

	//Output high level from P05.
	R_PG_IO_PORT_Write_P05( 0x01 );
}
```

5.11.7 R_PG_IO_PORT_SetPortNotAvailable

Definition bool R_PG_IO_PORT_SetPortNotAvailable (void)

Description Configure I/O port pins that are not available.

Parameter None

Return value

true	Setting was made correctly

File for output R_PG_IO_PORT.c

RPDL function R_IO_PORT_NotAvailable

Details

- All ports that are not available on smaller packages will be configured for CMOS-type low-level output.
- When using packages other than 100-pin, call this function first.

Example Refer to the example of R_PG_IO_PORT_Set_P<*port number*>.

5.12 Multi-Function Timer Pulse Unit 2 (MTU2a)

5.12.1 R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*>

Definition bool R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*> (void)
<*unit number*>: 0
<*channels*>: C0 to C5
C3_C4 (Complementary PWM mode or reset-synchronized PWM mode)

Description Set up the MTU

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function R_MTU2_Set, R_MTU2_Create

Details

- Releases the MTU from the module-stop and makes initial settings.
- Interrupts of the MTU are set by this function. When the name of the interrupt notification function has been specified in the GUI, if an interrupt occurs in the CPU, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of section Notes on Notification Functions.
- If the interrupt propriety level is set to 0 in the GUI, a CPU interrupt does not occur. The state of a request flag can be acquired by calling R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>.
- When counting driven by an externally input clock, the external reset signal, input capture, or pulse output is in use, the pin to be used is set in this function.
- To start the count operation, call R_PG_Timer_StartCount_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>) or R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*> after calling this function.
- In complementary PWM mode or reset-synchronized PWM mode, paired channels are set up in the same time. Channels 3 and 4 are set up by R_PG_Timer_Set_MTU_U0_C3_C4.
- In complementary PWM mode or reset-synchronized PWM mode, PWM output is disabled in the initial state. To enable the pin output, call R_PG_Timer_ControlOutputPin_MTU_U<*unit number*>_<*channels*> before starting the count operation.

Example 1 A case where the setting is made as follows.

- MTU channel 1 was set up in normal mode
- Mtu1IcCmAIntFunc was specified as a compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C1();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();	// Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	//Processing in response to a compare match A interrupt
}
```

Example 2 A case where the setting is made as follows.

- MTU channel 3 and 4 were set up in complementary PWM mode

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	//Set up the MTU3 and MTU4 in complementary PWM mode
	R_PG_Timer_Set_MTU_U0_C3_C4 ();

	//Enable PWM output pin 1 positive and negative phase
	R_PG_Timer_ControlOutputPin_MTU_U0_C3_C4(
		1, //p1 : enable
		1, //n1 : enable
		0, //p2 : disable
		0, //n2 : disable
		0, //p3 : disable
		0 //n3 : disable
	);

	// Start the MTU3 and 4 count operation
	R_PG_Timer_SynchronouslyStartCount_MTU_U0(
		0, //ch0
		0, //ch1
		0, //ch2
		1, //ch3
		1 //ch4
	);
}
```

5.12.2 R_PG_Timer_StartCount_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>)

Definition

bool R_PG_Timer_StartCount_MTU_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0
<*channel number*>: 0 to 5

bool R_PG_Timer_StartCount_MTU_U<*unit number*>_C<*channel number*>_<*phase*> (void)
<*unit number*>: 0
<*channel number*>: 5
<*phase*>: U, V or W

Description

Start the MTU count operation

Parameter

None

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ControlChannel

Details

- Starts the MTU count operation.
- Call R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*> to make the initial settings before calling this function.
- In complementary PWM mode or reset-synchronized PWM mode, start the count operation of paired 2 channels simultaneously by R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*>.
- R_PG_Timer_StartCount_MTU_U0_C5 can start the count of U, V, and W phase simultaneously.

Example

A case where the setting is made as follows.

- MTU channel 1 was set up
- Mtu1IcCmAIntFunc was specified as the compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C1();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();	// Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	R_PG_Timer_HaltCount_MTU_U0_C1();	//Halt the count operation
	func_cmA();	//Processing in response to a compare match A interrupt
	R_PG_Timer_StartCount_MTU_U0_C1();	//Resume the count operation
}
```

5.12.3 R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*>

Definition
bool R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*>
(bool ch0, bool ch1, bool ch2, bool ch3, bool ch4)
<*unit number*>: 0

Description
Start the MTU count operation of two or more channels simultaneously

Parameter

bool ch0	Count operation of channel 0 (0:Do not start count 1:Start count)
bool ch1	Count operation of channel 1 (0:Do not start count 1:Start count)
bool ch2	Count operation of channel 2 (0:Do not start count 1:Start count)
bool ch3	Count operation of channel 3 (0:Do not start count 1:Start count)
bool ch4	Count operation of channel 4 (0:Do not start count 1:Start count)

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_Timer_MTU_U<*unit number*>.c
<*unit number*>: 0

RPDL function
R_MTU2_ControlUnit

Details
- Starts the MTU count operation of two or more channels simultaneously.
- Call R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*> to make the initial settings before calling this function.
- In complementary PWM mode or reset-synchronized PWM mode, start the count operation of paired 2 channels simultaneously by this function.

Example
Refer to the example 2 of R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*>

5.12.4 R_PG_Timer_HaltCount_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>)

Definition

bool R_PG_Timer_HaltCount_MTU_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0
<*channel number*>: 0 to 5

bool R_PG_Timer_HaltCount_MTU_U<*unit number*>_C<*channel number*>_<*phase*> (void)
<*unit number*>: 0
<*channel number*>: 5
<*phase*>: U, V or W

Description

Halt the MTU count operation

Parameter

None

Return value

true	Halting succeeded.
false	Halting failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ControlChannel

Details

- Halts the MTU count operation.
- To make the MTU resume counting, call R_PG_Timer_StartCount_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>) or R_PG_Timer_SynchronouslyStartCount_MTU_U<*unit number*>.
- R_PG_Timer_HaltCount_MTU_U0_C5 can stop the count of U, V, and W phase simultaneously.

Example

A case where the setting is made as follows.

- MTU channel 1 was set up
- Mtu1IcCmAIntFunc was specified as the compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C1();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();	// Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	R_PG_Timer_HaltCount_MTU_U0_C1();	//Halt the count operation
	func_cmA();	//Processing in response to a compare match A interrupt
	R_PG_Timer_StartCount_MTU_U0_C1();	//Resume the count operation
}
```

5.12.5 R_PG_Timer_GetCounterValue_MTU_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_GetCounterValue_MTU_U<*unit number*>_C<*channel number*>
(uint16_t * counter_val)
<*unit number*>: 0
<*channel number*>: 0 to 4

bool R_PG_Timer_GetCounterValue_MTU_U<*unit number*>_C<*channel number*>
(uint16_t * counter_u_val, uint16_t * counter_v_val, uint16_t * counter_w_val)
<*unit number*>: 0
<*channel number*>: 5

Description

Acquire the MTU counter value

Parameter

For MTU0 to MTU4

uint16_t * counter_val	Destination for storage of the counter value

For MTU5

uint16_t * counter_u_val	Destination for storage of the counter U value
uint16_t * counter_v_val	Destination for storage of the counter V value
uint16_t * counter_w_val	Destination for storage of the counter value

Return value

true	Acquisition of the counter value succeeded.
false	Acquisition of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ReadChannel

Details

- Acquires the counter value of a MTU.

Example

A case where the setting is made as follows.
- MTU channel 0 was set up
- Set TGRA as an input capture register and enable an input capture A interrupt
- Mtu0IcCmAIntFunc was specified as the input capture A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

uint16_t counter_val;

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C0();	//Set up the MTU0
	R_PG_Timer_StartCount_MTU_U0_C0();	// Start the count operation
}

void Mtu0IcCmAIntFunc(void)
{
	// Acquire the value of the MTU0 counter
	R_PG_Timer_GetCounterValue_MTU_U0_C0( & counter_val );
}
```

5.12.6 R_PG_Timer_SetCounterValue_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>)

Definition

bool R_PG_Timer_SetCounterValue_MTU_U<*unit number*>_C<*channel number*>
(uint16_t counter_val)
<*unit number*>: 0 <*channel number*>: 0 to 4

bool R_PG_Timer_SetCounterValue_MTU_U<*unit number*>_C<*channel number*>_<*phase*>
(uint16_t counter_val)
<*unit number*>: 0 <*channel number*>: 5 <*phase*>: U, V or W

bool R_PG_Timer_SetCounterValue_MTU_U<*unit number*>_C<*channel number*>
(uint16_t counter_u_val, uint16_t counter_v_val, uint16_t counter_w_val)
<*unit number*>: 0 <*channel number*>: 5

Description

Set the MTU counter value

Parameter

For MTU0 to MTU7

uint16_t counter_val	Value to be written to the counter

For MTU5

uint16_t counter_u_val	Value to be written to the counter U
uint16_t counter_v_val	Value to be written to the counter V
uint16_t counter_w_val	Value to be written to the counter W

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ControlChannel

Details

- Set the counter value of a MTU.

Example

A case where the setting is made as follows.

- MTU channel 1 was set up
- Set TGRA as an output compare register and enable a compare match A interrupt
- Mtu1IcCmAIntFunc was specified as the compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
	R_PG_Timer_Set_MTU_U0_C1();    //Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();    // Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	R_PG_Timer_SetCounterValue_MTU_U0_C1( 0 );    //Clear the counter
}
```

5.12.7 R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>
(bool* cm_ic_a, bool* cm_ic_b, bool* cm_ic_c, bool* cm_ic_d,
bool* cm_e, bool* cm_f, bool* ov, bool* un);
<*unit number*>: 0
<*channel number*>: 0 to 4

bool R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>
(bool* cm_ic_u, bool* cm_ic_v, bool* cm_ic_w);
<*unit number*>: 0
<*channel number*>: 5

Description

Acquire and clear the MTU interrupt flags

Parameter

bool* cm_ic_a	The address of storage area for the compare match/input capture A flag
bool* cm_ic_b	The address of storage area for the compare match/input capture B flag
bool* cm_ic_c	The address of storage area for the compare match/input capture C flag
bool* cm_ic_d	The address of storage area for the compare match/input capture D flag
bool* cm_e	The address of storage area for the compare match E flag
bool* cm_f	The address of storage area for the compare match F flag
bool* ov	The address of storage area for the overflow flag
bool* un	The address of storage area for the underflow flag
bool* cm_ic_u	The address of storage area for the compare match/input capture U flag
bool* cm_ic_v	The address of storage area for the compare match/input capture V flag
bool* cm_ic_w	The address of storage area for the compare match/input capture W flag

Available flags for each channel are as follows.

MTU0	cm_ic_a to cm_ic_d, cm_e, cm_f, and ov
MTU1, 2	cm_ic_a, cm_ic_b, ov, and un
MTU3, 4	cm_ic_a to cm_ic_d, and ov
MTU5	cm_ic_u, cm_ic_v, and cm_ic_w
MTU3 (complementary PWM mode and reset-synchronized PWM mode)	cm_ic_a to cm_ic_d
MTU4 (complementary PWM mode and reset-synchronized PWM mode)	cm_ic_a to cm_ic_d, and un

Return value

true	Acquisition of the flags succeeded
false	Acquisition of the flags failed

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ReadChannel

Details

- This function acquires the interrupt flags of MTU.
- All flags will be cleared in this function.
- Specify the address of storage area for the flags to be acquired.
  Specify 0 for a flag that is not required.

Example A case where the setting is made as follows.

- MTU channel 1 was set up
- TGRA is set as an output compare register and the compare match interrupt is enabled
- The priority level of compare match interrupt is set to 0

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

bool cma_flag;

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C1();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();	// Start the count operation

	//Wait for the compare match A
	do{
		R_PG_Timer_GetRequestFlag_MTU_U0_C1(
			& cma_flag, //a
			0, //b
			0, //c
			0, //d
			0, //e
			0, //f
			0, //e
			0, //ov
			0 //un
		);
	} while( !cma_flag );

	//Processing in response to a compare match A

}
```

5.12.8 R_PG_Timer_StopModule_MTU_U<*unit number*>

Definition: bool R_PG_Timer_StopModule_MTU_U<*unit number*> (void)
<*unit number*>: 0

Description: Shut down the MTU unit

Parameter: None

Return value:

true	Shutting down succeeded
false	Shutting down failed

File for output: R_PG_Timer_MTU_U<*unit number*>.c
<*unit number*>: 0

RPDL function: R_MTU2_Destroy

Details:
- Stops a MTU and places it in the module-stop state. If two or more channels are running when this function is called, all channels will be stopped. Call R_PG_Timer_HaltCount_MTU_U<*unit number*>_C<*channel number*>(_<*phase*>) to stop a single channel.

Example: A case where the setting is made as follows.
- MTU channel 1 was set up
- Set TGRA as an output compare register and enable a compare match A interrupt Mtu1IcCmAIntFunc was specified as the compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C1();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();	// Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	// Stop the MTU unit 0
	R_PG_Timer_StopModule_MTU_U0();
}
```

5.12.9 R_PG_Timer_GetTGR_MTU_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>
(uint16_t* tgr_a_val, uint16_t* tgr_b_val, uint16_t* tgr_c_val,
uint16_t* tgr_d_val, uint16_t* tgr_e_val, uint16_t* tgr_f_val);
<*unit number*>: 0
<*channel number*>: 0 to 4

bool R_PG_Timer_GetRequestFlag_MTU_U<*unit number*>_C<*channel number*>
(uint16_t * tgr_u_val, uint16_t * tgr_v_val, uint16_t * tgr_w_val);
<*unit number*>: 0
<*channel number*>: 5

Description

Acquire the general register value

Parameter

uint16_t* tgr_a_val	The address of storage area for the general register A value
uint16_t* tgr_b_val	The address of storage area for the general register B value
uint16_t* tgr_c_val	The address of storage area for the general register C value
uint16_t* tgr_d_val	The address of storage area for the general register D value
uint16_t* tgr_e_val	The address of storage area for the general register E value
uint16_t* tgr_f_val	The address of storage area for the general register F value
uint16_t* tgr_u_val	The address of storage area for the general register U value
uint16_t* tgr_v_val	The address of storage area for the general register V value
uint16_t* tgr_w_val	The address of storage area for the general register W value

Available arguments for each channel are as follows.

MTU0	tgr_a_val to tgr_f_val
MTU1, 2	tgr_a_val and tgr_b_val
MTU3, 4	tgr_a_val to tgr_d_val
MTU5	tgr_u_val to tgr_w_val

Return value

true	Acquisition of the flags succeeded
false	Acquisition of the flags failed

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 0 to 5

RPDL function

R_MTU2_ReadChannel

Details

- This function acquires the general register value.
- Specify the address of storage area for an item to be acquired. Specify 0 for an item that is not required.

Example

A case where the setting is made as follows.

- MTU channel 0 was set up
- Set TGRA as an input capture register and enable an input capture A interrupt
- Mtu0IcCmAIntFunc was specified as the input capture A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

uint16_t tgr_a_val;

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C0();		//Set up the MTU0
	R_PG_Timer_StartCount_MTU_U0_C0();	// Start the count operation
}

void Mtu0IcCmAIntFunc(void)
{
	// Acquire the value of the TGRA
	R_PG_Timer_GetTGR_MTU_U0_C0(
		& tgr_a_val, //a
		0, //b
		0, //c
		0, //d
		0, //e
		0 //f
	);
}
```

5.12.10 R_PG_Timer_SetTGR_<*general register*>_MTU_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_SetTGR_<*general register*>_MTU_U<*unit number*>_C<*channel number*> (uint16_t value);

<*general register*>:

MTU1, 2	: A or B
MTU3, 4	: A, B, C or D
MTU5	: U, V or W

<*unit number*>: 0

<*channel number*>: 0 to 5

Description

Set the general register value

Parameter

uint16_t value	Value to be written to the general register

Return value

true	Setting of the general register succeeded.
false	Setting of the general register failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c

<*unit number*>: 0

<*channel number*>: 0 to 5

RPDL function

R_MTU2_ControlChannel

Details

- This function sets the general register value.

Example

A case where the setting is made as follows.

- MTU channel 1 was set up
- Set TGRA as an output compare register and enable a compare match A interrupt
- Mtu1IcCmAIntFunc was specified as the compare match A interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
	R_PG_Timer_Set_MTU_U0_C1();    //Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C1();    // Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	R_PG_Timer_SetTGR_A_MTU_U0_C1( 1000 );    //Set TGRA
}
```

5.12.11 R_PG_Timer_SetBuffer_AD_MTU_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_SetBuffer_AD_MTU_U<*unit number*>_C<*channel number*>
(uint16_t tadcobr_a_val, uint16_t tadcobr_b_val);
<*unit number*>: 0
<*channel number*>: 4

Description

Set A/D converter start request cycle set buffer registers (TADCOBRA and TADCOBRB)

Conditions for output

The buffer transfer of A/D converter start request cycle value is enabled.

Parameter

uint16_t tadcobr_a_val	Value to be written to TADCOBRA
uint16_t tadcobr_b_val	Value to be written to TADCOBRB

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3(*), 4
(* complementary PWM mode and reset-synchronized PWM mode)

RPDL function

R_MTU2_ControlChannel

Details

- This function sets the TADCOBRA and TADCOBRB values.

Example

A case where the setting is made as follows.

- Buffer transfer of A/D converter start request cycle set register has been enabled

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
	R_PG_Timer_Set_MTU_U0_C4();	//Set up the MTU1
	R_PG_Timer_StartCount_MTU_U0_C4();	// Start the count operation
}

void Mtu1IcCmAIntFunc(void)
{
	// Set TADCOBRA and TADCOBRB
	R_PG_Timer_SetBuffer_AD_MTU_U0_C4( 0x10, 0x20 );
}
```

5.12.12 R_PG_Timer_SetBuffer_CycleData_MTU_U<*unit number*>_<*channels*>

Definition

bool R_PG_Timer_SetBuffer_CycleData_MTU_U<*unit number*>_<*channels*>
(uint16_t tcbr_val);
<*unit number*>: 0
<*channels*>: C3_C4

Description

Set the cycle buffer register

Conditions for output

MTU channels are set to complementary PWM mode

Parameter

uint16_t tcbr_val	Value to be written to the cycle buffer registerr

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3

RPDL function

R_MTU2_ControlUnit

Details

- This function sets the cycle buffer register (TCBR).

Example

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
        R_PG_Timer_SetBuffer_CycleData_MTU_U0_C3_C4(0x1000);
}
```

5.12.13 R_PG_Timer_SetOutputPhaseSwitch_MTU_U<*unit number*>_<*channels*>

Definition

bool R_PG_Timer_SetOutputPhaseSwitch_MTU_U<*unit number*>_<*channels*>
(uint8_t output_level);
<*unit number*>: 0
<*channels*>: C3_C4

Description

Switch PWM output level

Conditions for output

- The MTU channels are set to complementary PWM mode or reset-synchronized PWM mode
- The brushless DC motor control is enabled and the software is selected for the output control method

Parameter

uint8_t output_level	PWM output setting (0 to 5)

The output level for each value is as follows

Value	MTIOC3B U phase	MTIOC4A V phase	MTIOC4B W phase	MTIOC3D U phase	MTIOC4C V phase	MTIOC4D W phase
0	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	ON
2	OFF	ON	OFF	ON	OFF	OFF
3	OFF	ON	OFF	OFF	OFF	ON
4	OFF	OFF	ON	OFF	ON	OFF
5	ON	OFF	OFF	OFF	ON	OFF
6	OFF	OFF	ON	ON	OFF	OFF
7	OFF	OFF	OFF	OFF	OFF	OFF

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3

RPDL function

R_MTU2_ControlUnit

Details

- This function switches the PWM output level in brushless DC motor control

Example

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
        R_PG_Timer_SetOutputPhaseSwitch_MTU_U0_C3_C4(0x7);
}
```

5.12.14 R_PG_Timer_ControlOutputPin_MTU_U<*unit number*>_<*channels*>

Definition

bool R_PG_Timer_ControlOutputPin_MTU_U<*unit number*>_<*channels*>
(bool p1_enable, bool n1_enable, bool p2_enable, bool n2_enable,
bool p3_enable, bool n3_enable)
<*unit number*>: 0
<*channels*>: C3_C4

Description

Enable or disable the PWM output

Conditions for output

MTU channels are set to complementary PWM mode or reset-synchronized PWM mode

Parameter

bool p1_enable	U positive phase (MTIOCmB) output (0: Disable 1: Enable)
bool n1_enable	U negative phase (MTIOCmD) output (0: Disable 1: Enable)
bool p2_enable	V positive phase (MTIOCnA) output (0: Disable 1: Enable)
bool n2_enable	V negative phase (MTIOCnC) output (0: Disable 1: Enable)
bool p3_enable	W positive phase (MTIOCnB) output (0: Disable 1: Enable)
bool n3_enable	W negative phase (MTIOCnD) output (0: Disable 1: Enable)

m : 3 n : 4

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3

RPDL function

R_MTU2_ControlUnit

Details

- This function enables or disables PWM output in complementary PWM mode or reset-synchronized PWM mode.
- In complementary PWM mode or reset-synchronized PWM mode, PWM output is disabled in the initial state. To enable the pin output, call this function before starting the count operation.

Example

Refer to the example 2 of R_PG_Timer_Set_MTU_U<*unit number*>_<*channels*>

5.12.15 R_PG_Timer_SetBuffer_PWMOutputLevel_MTU_U<*unit number*>_<*channels*>

Definition

bool R_PG_Timer_SetBuffer_PWMOutputLevel_MTU_U<*unit number*>_<*channels*>
(bool p1_high, bool n1_high, bool p2_high, bool n2_high,
bool p3_high, bool n3_high)
<*unit number*>: 0
<*channels*>: C3_C4

Description

Set the PWM output level in the buffer register

Conditions for output

- MTU channels are set to complementary PWM mode or reset-synchronized PWM mode
- Buffer transfer of PWM output level setting is enabled

Parameter

bool p1_high	U positive phase (MTIOCmB) output
bool n1_high	U negative phase (MTIOCmD) output
bool p2_high	V positive phase (MTIOCnA) output
bool n2_high	V negative phase (MTIOCnC) output
bool p3_high	W positive phase (MTIOCnB) output
bool n3_high	W negative phase (MTIOCnD) output

m : 3 n : 4

The output level in each value is as follows

Value	Category	Positive phase	Negative phase
0	Active level	Low	Low
	Initial output	Low	Low
	Compare match when up count	Low	High
	Compare match when down count	High	Low
1	Active level	High	High
	Initial output	High	High
	Compare match when up count	High	Low
	Compare match when down count	Low	High

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3

RPDL function

R_MTU2_ControlUnit

Details

- This function sets the output level settings to the timer output level buffer register (TOLBR)

Example

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
    R_PG_Timer_SetBuffer_PWMOutputLevel_MTU_U0_C3_C4( 0, 0, 0, 0, 0, 0 );
}
```

5.12.16 R_PG_Timer_ControlBufferTransfer_MTU_U<*unit number*>_<*channels*>

Definition

bool R_PG_Timer_ControlBufferTransfer_MTU_U<*unit number*>_<*channels*>
(bool enable)
<*unit number*>: 0
<*channels*>: C3_C4

Description

Enable or disable buffer transfer from the buffer registers to the temporary registers

Conditions for output

- The MTU channels are set to complementary PWM mode
- Interrupt skipping function is set

Parameter

bool enable	Buffer transfer control (0 :Disable 1 :Enable)

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_MTU_U<*unit number*>_C<*channel number*>.c
<*unit number*>: 0
<*channel number*>: 3

RPDL function

R_MTU2_ControlUnit

Details

- This function enables or disables transfer from the buffer registers used in complementary PWM mode to the temporary registers.

Example

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func (void)
{
        R_PG_Timer_ControlBufferTransfer_MTU_U0_C3_C4( 1 );
}
```

5.13 Port Output Enable 2 (POE2a)

5.13.1 R_PG_POE_Set

Definition bool R_PG_POE_Set (void)

Description Set up the POE

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_POE.c

RPDL function R_POE_Set, R_POE_Create

- Sets up the output control of MTU0, 3 and 4 pins, the POE pins used for high-impedance request signal input, and the output enable interrupt.
- The MTU module is not set up in this function.
- Do not set pins that are not used for MTU output.
- When the name of the interrupt notification function has been specified in the GUI, if an interrupt occurs in the CPU, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of section Notes on Notification Functions.

A case where the setting is made as follows.

Example

- The output enable interrupt 2(OEI2) has been set
  PoeOei2IntFunc has been specified as an interrupt notification function name

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_POE_Set();		// Set up the POE
}

void PoeOei2IntFunc (void)
{
	// Processing when the output enable interrupt occurs
}
```

5.13.2 R_PG_POE_SetHiZ_<*Timer channels*>

Definition: bool R_PG_POE_SetHiZ_<*Timer channels*>(void)
<*Timer channels*>: MTU3_4, MTU0

Description: Place the timer output pins in high-impedance state

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_POE.c

RPDL function: R_POE_Control

Details: Places MTU0, 3, 4 output pins in high-impedance state.

Example: A case where the setting is made as follows.

- MTU0 pin output has been set (Setting of MTU)
- MTU0 output pins have been set to be controlled by the high impedance request

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func1(void)
{
	R_PG_Timer_Set_MTU_U0_C0();	//Set up the MTU0
	R_PG_POE_Set();	// Set up the POE
	R_PG_Timer_StartCount_MTU_U0_C0();	//Start the count operation of MTU0
}

void func2(void)
{
	R_PG_POE_SetHiZ_MTU0();	// Place the MTU0 output pins in high-impedance state
}
```

5.13.3 R_PG_POE_GetRequestFlagHiZ_<*Timer channels/flag*>

Definition

bool R_PG_POE_GetRequestFlagHiZ_MTU3_4
(bool * poe0, bool * poe1, bool * poe2, bool * poe3)

bool R_PG_POE_GetRequestFlagHiZ_MTU0 (bool * poe8)

bool R_PG_POE_GetRequestFlagHiZ_OSTSTF (bool * oststf)

Description

Acquire the high-impedance request flags

Parameter

bool* poe0	The address of storage area for POE0# high-impedance request flags
bool* poe1	The address of storage area for POE1# high-impedance request flags
bool* poe2	The address of storage area for POE2# high-impedance request flags
bool* poe3	The address of storage area for POE3# high-impedance request flags
bool* poe8	The address of storage area for POE8# high-impedance request flags
bool * oststf	The address of storage area for OSTST high-impedance flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_POE.c

RPDL function R_POE_GetStatus

Details

- Acquires the flags of high-impedance request signals input to POEn#pins (POEnF). (n:0 to 3 and 8)
- Specify the address of storage area for the flags to be acquired. Specify 0 for a flag that is not required.
- The flag is valid only when the POE pin is set to a high-impedance request input in GUI.

Example

A case where the setting is made as follows.

- MTU3 and 4 pin output has been set (Setting of MTU)
- MTU3 and 4 output pins have been set to be controlled by the high impedance request
- POE0 has been selected as a high-impedance request signal input

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool poe0;

void func(void)
{
	R_PG_Timer_Set_MTU_U0_C3();	//Set up the MTU
	R_PG_POE_Set();	// Set up the POE
	R_PG_Timer_StartCount_MTU_U0_C3();	//Start the count operation of MTU

	//Wait for the high-impedance request signal to be input
	do{
		R_PG_POE_GetRequestFlagHiZ_MTU3_4( &poe0, 0, 0, 0 );
	}while( ! poe0 );

	//Processing when the high-impedance request signal is input

	R_PG_POE_ClearFlag_MTU3_4();	//Clear high-impedance request flag
}
```

5.13.4 R_PG_POE_GetShortFlag_<*Timer channels*>

Definition bool R_PG_POE_GetShortFlag_<*Timer channels*> (bool * detected)

<*Timer channels*>: MTU3_4

Description Acquire the MTU output short flags

Parameter

bool* detected	The address of storage area for the output short flag (OSF1)

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_POE.c

RPDL function R_POE_GetStatus

Details

- Acquires the MTU3 ,4 complementary PWM output short flags (OSF1).

Example

A case where the setting is made as follows.

- The output enable interrupt1(OEI1) has been set.
- PoeOei1IntFunc has been specified as the output enable interrupt 1 notification function name.

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_POE_Set();	// Set up the POE
}

void PoeOei1IntFunc(void)
{
	bool detected;

	//Acquire the output short flag
	R_PG_POE_GetShortFlag_MTU3_4 (&detected);

	if( detected ){
		//Processing when MTU3,4 output short is detected

		R_PG_POE_ClearFlag_MTU3_4();	// Clear the output short flag(OSF1)
	}
}
```

5.13.5 R_PG_POE_ClearFlag_<*Timer channels/flag*>

Definition
bool R_PG_POE_ClearFlag_<*Timer channels/flag*> (void)
<*Timer channels/flag*>: MTU3_4, MTU0, OSTSTF

Description
Clear the high-impedance request flags and the output short flags

Parameter
None

Return value

true	Clearing succeeded
false	Clearing failed

File for output
R_PG_POE.c

RPDL function
R_POE_Control

Details
- Clears the high-impedance request flags and the output short flags.
- The flags that shall be cleared by each function are as follows.

Timer channels / flag	Flags
MTU3, 4	POEn request flag (POEnF) (n:0 to 3) MTU3,4 output short flag(OSF1)
MTU0	POE8 request flag (POE8F)
OSTSTF	OSTST high-impedance flag

Example
Refer to the example of R_PG_POE_GetShortFlag_<*Timer channels*>

5.14 8-Bit Timer (TMR)

5.14.1 R_PG_Timer_Start_TMR_U<*unit number*>(_C<*channel number*>)

Definition
bool R_PG_Timer_Start_TMR_U<*unit number*>(_C<*channel number*>) (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3
((_C<*channel number*>) is added in the 8-bit mode)

Description
Set up the TMR and start the count operation

Parameter
None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 and 1

RPDL function
R_TMR_Set
R_TMR_CreateChannel (8-bit mode)
R_TMR_CreateUnit (16-bit mode)

Details

- Releases the TMR from the module-stop, makes initial settings, and starts the TMR counting. The initial settings are made per channel in the 8-bit mode and per unit in the 16-bit mode (when the two channels of a unit are cascade-connected).
- Interrupts of the TMR are set by this function. When the name of the interrupt notification function has been specified in the GUI, if an interrupt occurs in the CPU, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of this chapter end, Notes on Notification Functions.
  If the interrupt propriety level is set to 0 in the GUI, a CPU interrupt does not occur. The state of a request flag can be acquired by calling R_PG_Timer_GetRequestFlag_TMR_U<*unit number*>(_C<*channel number*>).
- When counting driven by an externally input clock, the external reset signal, or pulse output is in use, sets the pins to be used in this function.

Example1

The 16-bit timer mode has been specified for TMR unit 1.

In this case, the following interrupt notification functions have been set in the GUI.

Overflow interrupt: TmrOf2IntFunc

Compare match A interrupt: TmrCma2IntFunc

Compare match B interrupt: TmrCmb2IntFunc

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Place TMR unit 1 in the 16-bit mode.
	R_PG_Timer_Start_TMR_U1();
}

void TmrOf2IntFunc(void)
{
	func_of();	//Processing in response to an overflow interrupt
}

void TmrCma2IntFunc(void)
{
	func_cma();	//Processing in response to a compare match A interrupt
}

void TmrCmb2IntFunc(void)
{
	func_cmb();	//Processing in response to a compare match B interrupt
}
```

Example2

The 8-bit timer mode has been specified for TMR0 in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
	bool cma_flag;

	//Place TMR0 in the 8-bit mode and start it counting.
	R_PG_Timer_Start_TMR_U0_C0();

	while(1){
		bool flag;
		//Acquire the compare match A interrupt request flag.
		R_PG_Timer_GetRequestFlag_TMR_U0_C0( &cma_flag, 0, 0 );

		if( cma_flag ){
			func_cma0();	//Processing of IRQ0
		}
	}
}
```

5.14.2 R_PG_Timer_HaltCount_TMR_U<*unit number*>(_C<*channel number*>)

Definition

bool R_PG_Timer_HaltCount_TMR_U<*unit number*>(_C<*channel number*>) (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3
((_C<*channel number*>) is added in the 8-bit mode.)

Description

Halt the TMR count operation

Parameter

None

Return value

true	Halting succeeded.
false	Halting failed.

File for output

R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_TMR_ControlChannel (8-bit mode)
R_TMR_ControlUnit (16-bit mode)

Details

- Halts the TMR count operation. To make the TMR resume counting, call the following function.
  R_PG_Timer_ResumeCount_TMR_U<*unit number*>(_C<*channel number*>)

Example

The 8-bit timer mode was specified for TMR0 in the GUI.
TmrCma0IntFunc was specified as the name of the compare match A interrupt function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Place TMR0 in the 8-bit mode.
	R_PG_Timer_Start_TMR_U0_C0();
}

void TmrCma0IntFunc(void)
{
	//Halt counting by TMR0.
	R_PG_Timer_HaltCount_TMR_U0_C0();

	func_cma();	//Processing in response to a compare match A interrupt

	//Resume counting by TMR0.
	R_PG_Timer_ResumeCount_TMR_U0_C0();
}
```

5.14.3 R_PG_Timer_ResumeCount_TMR_U<*unit number*>(_C<*channel number*>)

Definition

bool R_PG_Timer_ResumeCount_TMR_U<*unit number*>(_C<*channel number*>) (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3
((_C<*channel number*>) is added in the 8-bit mode.)

Description

Resume the TMR count operation

Parameter

None

Return value

true	Resuming count succeeded.
false	Resuming count failed.

File for output

R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_TMR_ControlChannel (8-bit mode)
R_TMR_ControlUnit (16-bit mode)

Details

- Resumes counting by a TMR that was halted by R_PG_Timer_HaltCount_TMR_U<*unit number*>(_C<*channel number*>).

Example

Refer to the example of R_PG_Timer_HaltCount_TMR_U<*unit number*>(_C<*channel number*>)

5.14.4 R_PG_Timer_GetCounterValue_TMR_U<*unit number*>(_C<*channel number*>)

Definition

•8-bit mode

bool R_PG_Timer_GetCounterValue_TMR_U<*unit number*>_C<*channel number*> (uint8_t * data)

<*unit number*>: 0 or 1

<*channel number*>: 0 to 3

•16-bit mode

bool R_PG_Timer_GetCounterValue_TMR_U<*unit number*> (uint16_t * data)

<*unit number*>: 0 or 1

Description

Acquire the TMR counter value

Parameter

uint8_t * data (8-bit mode) uint16_t * data (16-bit mode)	Destination for storage of the counter value

Return value

true	Acquisition of the counter value succeeded.
false	Acquisition of the counter value failed.

File for output

R_PG_Timer_TMR_U<*unit number*>.c

<*unit number*>: 0 or 1

RPDL function

R_TMR_ReadChannel (8-bit mode)

R_TMR_ReadUnit (16-bit mode)

Details

- Acquires the counter value of a TMR.
  The value of the 8-bit counter for the specified channel is stored if the TMR unit is in the 8-bit timer mode. The counter values for both channels are stored as follows if the TMR unit is in the 16-bit mode.

Unit	b15 to b8	b7 to b0
0	TMR0 counter	TMR1 counter
1	TMR2 counter	TMR3 counter

*When the TMR unit is in the 16-bit mode, the higher-order bits are in TMR0 (or TMR2).

Example

The 8-bit timer mode was selected for TMR0 in the GUI.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

uint8_t counter_val;

void func1(void)
{
	R_PG_Timer_Start_TMR_U0_C0();	//Place TMR0 in the 8-bit mode.
}

void func2(void)
{
	//Acquire the value of a counter of TMR0.
	R_PG_Timer_GetCounterValue_TMR_U0_C0( &counter_val );
}
```

5.14.5 R_PG_Timer_SetCounterValue_TMR_U<*unit number*>(_C<*channel number*>)

Definition
•8-bit mode
bool R_PG_Timer_SetCounterValue_TMR_U<*unit number*>_C<*channel number*> (uint8_t data)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3
•16-bit mode
bool R_PG_Timer_SetCounterValue_TMR_U<*unit number*> (uint16_t data)
<*unit number*>: 0 or 1

Description
Set the TMR counter value

Parameter

uint8_t data (8-bit mode) uint16_t data (16-bit mode)	Value to be set to the counter

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output
R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function
R_TMR_ControlChannel (8-bit mode)
R_TMR_ControlUnit (16-bit mode)

Details
- Set the counter value of a TMR.
  The value of the 8-bit counter for the specified channel is stored if the TMR unit is in the 8-bit timer mode. The counter values for both channels are stored as follows if the TMR unit is in the 16-bit mode.

Unit	b15 to b8	b7 to b0
0	TMR0 counter	TMR1 counter
1	TMR2 counter	TMR3 counter

*When the TMR unit is in the 16-bit mode, the higher-order bits are in TMR0 (or TMR2).

Example
The 8-bit timer mode was selected for TMR0 in the GUI.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.
void func1(void)
{
	//Place TMR0 in the 8-bit mode.
	R_PG_Timer_Start_TMR_U0_C0();
}
void func2(void)
{

	//Set the value of a counter of TMR0.
	R_PG_Timer_SetCounterValue_TMR_U0_C0( 0 );
}
```

5.14.6 R_PG_Timer_GetRequestFlag_TMR_U<*unit number*>(_C<*channel number*>)

Definition

bool R_PG_Timer_GetRequestFlag_TMR_U<*unit number*>_C<*channel number*>
(bool* cma, bool* cmb, bool* ov);
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3
((_C<*channel number*>) is added in the 8-bit mode.)

Description

Acquire and clear the TMR interrupt flags

Parameter

bool* cma	The address of storage area for the compare match A flag
bool* cmb	The address of storage area for the compare match B flag
bool* ov	The address of storage area for the overflow flag

Return value

true	Acquisition of the flags succeeded
false	Acquisition of the flags failed

File for output

R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_TMR_ReadChannel (8-bit mode)
R_TMR_ReadUnit (16-bit mode)

Details

- This function acquires the interrupt flags of TMR.
- All flags will be cleared in this function.
- Specify the address of storage area for the flags to be acquired.
- Specify 0 for a flag that is not required.

Example

The 8-bit timer mode was selected for TMR0 in the GUI.

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

uint16_t counter;

void func(void)
{
    //Place TMR0 in the 8-bit mode.
    R_PG_Timer_Start_TMR_U0_C0();

    //Wait for the compare match A
    do{
        R_PG_Timer_GetRequestFlag_TMR_U0_C0(
            & cma_flag,
            0,
            0
        );
    } while( !cma_flag );

    func_cmA();     //Processing in response to a compare match A interrupt
}
```

5.14.7 R_PG_Timer_HaltCountElc_TMR_U<*unit number*>_C<*channel number*>

Definition
bool R_PG_Timer_HaltCountElc_TMR_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 or 2

Description
Stop the TMR operation that was started by the ELC

Parameter
None

Return value

true	Halting succeeded
false	Halting failed

File for output
R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function
R_TMR_ControlChannel

Details
- This function stops the TMR operation that was started in response to an event signal from the ELC. The TMR restarts counting when it receives the event signal from the ELC again.

Example
[TMR]
Unit 0: 8-bit timer mode
[ELC]
TMR0 operation when event is input: Counting is started

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func1(void)
{
    R_PG_Clock_Set();    //The clock-generation circuit has to be set first.

    R_PG_ELC_Set();     //Set up the event link controller (ELC).
    R_PG_ELC_SetLink_TMR0();    //Set an event link.

    R_PG_Timer_Start_TMR_U0_C0(); //Set up TMR

    R_PG_ELC_AllEventLinkEnable(); //Enable all event links.
}

void func2(void)
{
    //Stop the TMR operation that was started by the ELC
    R_PG_Timer_HaltCountElc_TMR_U0_C0();
}
```

5.14.8 R_PG_Timer_GetCountStateElc_TMR_U<*unit number*>_C<*channel number*>

Definition
bool R_PG_Timer_GetCountStateElc_TMR_U<*unit number*>_C<*channel number*> (bool * count_state)
<*unit number*>: 0 or 1
<*channel number*>: 0 or 2

Description
Acquire the state of the TMR operation that was started by the ELC

Parameter

bool * count_state	Destination for storage of the state of the TMR operation 0: Count stopped state in response to ELC. 1: Count start state in response to ELC.

Return value

true	Acquisition succeeded.
false	Acquisition failed.

File for output
R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function
R_TMR_ReadChannel

Details
- This function acquires the state of the TMR operation that was started by the ELC.

Example
[TMR]
Unit 0: 8-bit timer mode
[ELC]
TMR0 operation when event is input: Counting is started

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

bool count_state=0;

void func1(void)
{
     R_PG_Clock_Set();    //The clock-generation circuit has to be set first.

    R_PG_ELC_Set();    //Set up the event link controller (ELC).
    R_PG_ELC_SetLink_TMR0();    //Set an event link.

    R_PG_Timer_Start_TMR_U0_C0();    //Set up TMR

    R_PG_ELC_AllEventLinkEnable();     //Enable all event links.
}

void func2(void)
{
    //Acquire the state of the TMR operation that was started by the ELC
    R_PG_Timer_GetCountStateElc_TMR_U0_C0(&count_state);
}
```

5.14.9 R_PG_Timer_StopModule_TMR_U<*unit number*>

Definition bool R_PG_Timer_StopModule_TMR_U<*unit number*> (void)
<*unit number*>: 0 or 1

Description Shut down a TMR unit

Parameter None

Return value

true	Shutting down succeeded.
false	Shutting down failed.

File for output R_PG_Timer_TMR_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function R_TMR_Destroy

Details

- Stops a TMR unit and places it in the module-stop state per unit. If both TMR0 and TMR1 of unit 0 (or both TMR2 and TMR3 of unit 1) are running when this function is called, both channels are stopped. Call the following function to stop a single channel.
  R_PG_Timer_HaltCount_TMR_U<*unit number*>_C<*channel number*>

Example The 8-bit timer mode was selected for TMR0 in the GUI.
TmrCma0IntFunc was specified as the name of the compare match A interrupt function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Place TMR0 in the 8-bit mode.
	R_PG_Timer_Start_TMR_U0_C0();
}

void TmrCma0IntFunc(void)
{
	func_cma();	//Processing in response to a compare match A interrupt

	//Stop TMR unit 0.
	R_PG_Timer_StopModule_TMR_U0();
}
```

5.15 Compare Match Timer (CMT)

5.15.1 R_PG_Timer_Set_CMT_U<*unit number*>_C<*channel number*>

Definition
bool R_PG_Timer_Set_CMT_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3

Description
Set up the CMT

Parameter
None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 and 1

RPDL function
R_CMT_Create

Details

- Releases the CMT from the module-stop and makes initial settings.
- R_PG_Timer_StartCount_CMT_U<*unit number*>_C<*channel number*> can be used to start the count operation.
- Function R_PG_Clock_Set must be called before any use of this function.
- Interrupts of the CMT are set by this function. When the name of the interrupt notification function has been specified in the GUI, if an interrupt occurs in the CPU, the function having the specified name will be called. Create the interrupt notification function as follows:
  void <*name of the interrupt notification function*> (void)
  For the interrupt notification function, note the contents of this chapter end, Notes on Notification Functions.

Example
A case where the setting is made as follows.

- Cmt0IntFunc was specified as a compare match interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
        R_PG_Clock_Set(); //The clock-generation circuit has to be set first.
        R_PG_Timer_Set_CMT_U0_C0(); //Set up the CMT0
        R_PG_Timer_StartCount_CMT_U0_C0(); //Start the count operation
}

void Cmt0IntFunc(void)
{
        R_PG_Timer_HaltCount_CMT_U0_C0(); //Halt the CMT0 count operation

        func_cmt0();    //Processing in response to a compare match interrupt

        R_PG_Timer_StartCount_CMT_U0_C0(); //Resume the CMT0 count operation
}
```

5.15.2 R_PG_Timer_StartCount_CMT_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_StartCount_CMT_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3

Description

Start or resume the CMT count operation

Parameter

None

Return value

True	Starting or resuming count succeeded.
False	Starting or resuming count failed.

File for output

R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_CMT_Control

Details

- Starts counting by a CMT.
- Resumes counting by a CMT that was halted by R_PG_Timer_HaltCount_CMT_U<*unit number*>_C<*channel number*>.

Example

Refer to the example of R_PG_Timer_Set_CMT_U<*unit number*>_C<*channel number*>

5.15.3 R_PG_Timer_HaltCount_CMT_U<*unit number*>_C<*channel number*>

Definition
bool R_PG_Timer_HaltCount_CMT_U<*unit number*>_C<*channel number*> (void)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3

Description
Halt the CMT count operation

Parameter
None

Return value

true	Halting succeeded.
false	Halting failed.

File for output
R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function
R_CMT_Control

Details
- Halts the CMT count operation. To make the CMT resume counting, call the following function.
  R_PG_Timer_StartCount_CMT_U<*unit number*>_C<*channel number*>

Example
Refer to the example of R_PG_Timer_Set_CMT_U<*unit number*>_C<*channel number*>

5.15.4 R_PG_Timer_GetCounterValue_CMT_U<*unit number*>_C<*channel number*>

Definition
bool R_PG_Timer_GetCounterValue_CMT_U<*unit number*>_C<*channel number*>
(uint16_t * data)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3

Description
Acquire the CMT counter value

Parameter

uint16_t * data	Destination for storage of the counter value

Return value

true	Acquisition of the counter value succeeded.
false	Acquisition of the counter value failed.

File for output
R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function
R_CMT_Read

Details
- Acquires the counter value of a CMT.

Example
A case where the setting is made as follows.
- CMT unit 0 channel 0 was set up

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

uint16_t data;

void func1(void)
{
	R_PG_Clock_Set(); //The clock-generation circuit has to be set first.
	R_PG_Timer_Set_CMT_U0_C0(); //Set up the CMT0
	R_PG_Timer_StartCount_CMT_U0_C0(); //Start the count operation
}

void func2(void)
{
	//Acquire the value of a CMT0 counter
	R_PG_Timer_GetCounterValue_CMT_U0_C0( &data );
}
```

5.15.5 R_PG_Timer_SetCounterValue_CMT_U<*unit number*>_C<*channel number*>

Definition

bool R_PG_Timer_SetCounterValue_CMT_U<*unit number*>_C<*channel number*>
(uint16_t data)
<*unit number*>: 0 or 1
<*channel number*>: 0 to 3

Description

Set the CMT counter value

Parameter

uint16_t data	Value to be set to the counter

Return value

true	Setting of the counter value succeeded.
false	Setting of the counter value failed.

File for output

R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_CMT_Control

Details

- Set the counter value of a CMT.

Example

A case where the setting is made as follows.

- CMT unit 0 channel 0 was set up

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func1(void)
{
	R_PG_Clock_Set(); //The clock-generation circuit has to be set first.
	R_PG_Timer_Set_CMT_U0_C0(); //Set up the CMT0
	R_PG_Timer_StartCount_CMT_U0_C0(); //Start the count operation
}

void func2(void)
{
	//Set the value of a CMT0 counter
	R_PG_Timer_SetCounterValue_CMT_U0_C0( 0 );
}
```

5.15.6 R_PG_Timer_StopModule_CMT_U<*unit number*>

Definition

bool R_PG_Timer_StopModule_CMT_U<*unit number*> (void)
<*unit number*>: 0 or 1

Description

Shut down the CMT unit

Parameter

None

Return value

true	Shutting down succeeded.
false	Shutting down failed.

File for output

R_PG_Timer_CMT_U<*unit number*>.c
<*unit number*>: 0 or 1

RPDL function

R_CMT_Destroy

Details

- Stops a CMT unit and places it in the module-stop state per unit. If both CMT0 and CMT1 of unit 0 (or both CMT2 and CMT3 of unit 1) are running when this function is called, both channels are stopped. Call the following function to stop a single channel.
  R_PG_Timer_HaltCount_CMT_U<*unit number*>_C<*channel number*>

Example

A case where the setting is made as follows.

- CMT unit 0 channel 0 was set up
- Cmt0IntFunc was specified as the compare match interrupt notification function name

```
#include "R_PG_default.h" //Include "R_PG_<project name>.h" to use this function.

void func(void)
{
	R_PG_Clock_Set(); //The clock-generation circuit has to be set first.
	R_PG_Timer_Set_CMT_U0_C0(); //Set up the CMT0
	R_PG_Timer_StartCount_CMT_U0_C0(); //Start the count operation
}

void Cmt0IntFunc(void)
{
	func_cmt0(); //Processing in response to a compare match interrupt

	//Stop the CMT unit 0
	R_PG_Timer_StopModule_CMT_U0();
}
```

5.16 Realtime Clock (RTCc)

5.16.1 R_PG_RTC_Start

Definition: bool R_PG_RTC_Start (void)

Description: Sets up the RTC and starts its counter

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Create

Details:

- Sets up the alarm interrupt, cyclic interrupt, and 1-Hz clock output from the RTCOUT pin and starts the RTC's counter.
- Before calling this function, call R_PG_Clock_Set to set the clock.
- This function does not set the current time. When the alarm interrupt is to be used, call this function before R_PG_RTC_SetCurrentTime, which sets the current time.
- The alarm register is set when the time and date settings for the alarm are made through the GUI.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
#include "iodefine_RPDL.h"

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.

    if( SYSTEM.RSTSR1.BIT.CWSF == 1 ) { //Check the warm start flag
        R_PG_RTC_Start(); // Set up the RTC and start its counter.
        SYSTEM.RSTSR1.BIT.CWSF = 1; //Set the warm start flag
    }
    else {
        R_PG_RTC_WarmStart(); //Set up the RTC of warm start and start its counter
    }
}
```

5.16.2 R_PG_RTC_WarmStart

Definition bool R_PG_RTC_WarmStart (void)

Description Sets up the RTC of warm start and starts its counter

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_CreateWarm

Details

- Sets up the alarm interrupt, cyclic interrupt and starts the RTC's counter.
- Before calling this function, call R_PG_Clock_Set to set the clock.

Example Refer to the example of R_PG_RTC_Start.

5.16.3 R_PG_RTC_Stop

Definition bool R_PG_RTC_Stop (void)

Description Suspends counting by the RTC

Parameter None

Return value

true	Counting was successfully suspended.
false	Suspension failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details
- Suspends counting by the RTC.
- To restart counting, call R_PG_RTC_Restart.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter.
}

void func2(void)
{
    R_PG_RTC_Stop ();   // Suspend counting.
}

void func3(void)
{
    R_PG_RTC_Restart();   // Restart counting.
}
```

5.16.4 R_PG_RTC_Restart

Definition bool R_PG_RTC_Restart (void)

Description Restarts counting by the RTC

Parameter None

Return value

true	Counting was successfully restarted.
false	Restarting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details
- Allows the RTC to restart counting that was suspended by R_PG_RTC_Stop.

Example Refer to the example of R_PG_RTC_Stop.

5.16.5 R_PG_RTC_SetCurrentTime

Definition bool R_PG_RTC_SetCurrentTime
(uint8_t seconds, uint8_t minutes, bool pm, uint8_t hours,
uint8_t day, uint8_t month, uint16_t year)

Description Sets the current time

Parameter

uint8_t seconds	Seconds (valid range of values: 0x00 to 0x59, as BCD values)
uint8_t minutes	Minutes (valid range of values: 0x00 to 0x59, as BCD values)
bool pm	a.m./p.m. 0: a.m. 1: p.m.
uint8_t hours	Hours (valid range of values in 24-hour mode: 0x00 to 0x23, as BCD values; in 12-hour mode: 0x01 to 0x12, as BCD values)
uint8_t day	Date (valid range of values: 0x01 to the number of days in the specified month, as BCD values)
uint8_t month	Month (valid range of values: 0x01 to 0x12, as BCD values)
uint16_t year	Year (valid range of values: 0x0000 to 0x9999, as BCD values)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details
- Sets the current time.
- The value of the day-of-the-week counter is is figured out from the specified values for date, month, and year.
- When this function is called during counting, counting is suspended while the current time is set and resumed on completion of the settings.
- Specify valid values even for items that are not to be used for the alarm interrupt.
- In 24-hour mode, specify 0 for p.m.

Example
The following settings have been made through the GUI.
- Set up an alarm interrupt.
- Specify RtcAlmIntFunc as the alarm interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter.

    R_PG_RTC_SetCurrentTime( // Set the current time (03:44:55 on Nov. 22, 2000)
        0x55, // 55 seconds
        0x44, // 44 min
        0, // a.m.
        0x03, // 03 o'clock
        0x22, // 22nd
        0x11, // November
```

```
        0x2000 // 2000
    );
    R_PG_RTC_SetAlarmTime( // Set the alarm time (03:45:00 on Nov. 22, 2000)
        0x00, // 00 seconds
        0x45, // 45 minutes
        0, // a.m.
        0x03, // 03 o'clock
        0xff, // Day of the week (0xff: Automatically calculated from the date)
        0x22, // 22nd
        0x11, // November
        0x2000 // 2000
    );
    R_PG_RTC_AlarmControl( // Enable the year, month, date, day of the week, hour,
                           // minute, and second alarms.
        1, // Enable the seconds alarm
        1, // Enable the minutes alarm
        1, // Enable the hours alarm
        1, // Enable the day-of-the-week alarm
        1, // Enable the date alarm
        1, // Enable the month alarm
        1 // Enable the year alarm
    );
}
void RtcAlmIntFunc(void)
{
    // Alarm interrupt processing
}
```

5.16.6 R_PG_RTC_GetStatus

Definition

bool R_PG_RTC_GetStatus
(bool * hour_mode24, uint8_t * seconds, uint8_t * minutes, bool * pm,
uint8_t * hours, uint8_t * day_of_week, uint8_t * day, uint8_t * month,
uint16_t * year, bool * carry, bool * alarm, bool * period,
bool * adjustment, bool * reset, bool * running)

Description

Acquires information on the current state of the RTC

Parameter

bool * hour_mode24	Destination for storage of the hour-mode information (0:12-hour mode, 1: 24-hour mode)
uint8_t * seconds	Destination for storage of the current seconds-counter value
uint8_t * minutes	Destination for storage of the current minutes-counter value
bool * pm	Destination for storage of the a.m./p.m. value
uint8_t * hours	Destination for storage of the current hours-counter value
uint8_t * day_of_week	Destination for storage of the current day-of-the-week counter value
uint8_t * day	Destination for storage of the current date-counter value
uint8_t * month	Destination for storage of the current month-counter value
uint16_t * year	Destination for storage of the current year-counter value
bool * carry	Destination for storage of the incrementation interrupt flag
bool * alarm	Destination for storage of the alarm interrupt flag
bool * period	Destination for storage of the cyclic interrupt flag
bool * adjustment	Destination for storage of the 30-second unit adjustment bit (0: normal operation, 1: adjustment in progress)
bool * reset	Destination for storage of the reset bit (0: normal operation, 1: resetting in progress)
bool * running	Destination for storage of the start bit (0: clock stopped, 1: clock operating)

Return value

true	Acquisition succeeded.
false	Acquisition failed.

File for output

R_PG_RTC.c

RPDL function

R_RTC_Read

Details

- Acquires information on the current state of the RTC.
- For the parameter that corresponds to each of the items you wish to acquire, specify the address where the value is to be stored. For the items you do not wish to acquire, on the
- other hand, specify 0.
- The interrupt flag is cleared within this function.
  When the value of the incrementation interrupt flag is 1, the current time will change while the information is being acquired. Read the value again in such cases.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter.
}

void func2(void)
```

```
{
    do{
        // Acquire the values of the current time and incrementation interrupt flag.
            R_PG_RTC_GetStatus(
            &hour_mode24,//24-hour mode
            &seconds,    // Seconds
            &minutes,    // Minutes
            &pm,         // a.m./p.m.
            &hours,      // Hours
            0,           // Day of the week
            0,           // Date
            0,           // Month
            0,           // Year
            &carry,      // Incrementation interrupt flag
            0,           // Alarm interrupt flag
            0,           // Cyclic interrupt flag
            0,           // 30-second unit adjustment bit
            0,           // Reset bit
            0            // Start bit
        );
    } while( carry );
}
```

5.16.7 R_PG_RTC_Adjust30sec

Definition: bool R_PG_RTC_Adjust30sec (void)

Description: Performs 30-second unit adjustment

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:

- Performs 30-second unit adjustment (29 or fewer seconds are rounded down to 00 seconds while 30 or more seconds are treated as 1 minute).

Example:

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter.
}

void func2(void)
{
    R_PG_RTC_Adjust30sec(); // Perform 30-second unit adjustment.
}
```

5.16.8 R_PG_RTC_ManualErrorAdjust

Definition bool R_PG_RTC_ManualErrorAdjust (int8_t cycle)

Description Corrects an error of the timer

Parameter

int8_t cycle	Value (i.e. a number of subclock cycles) for use in correcting an error of the timer -63 to -1 : Put the timer back 0 to 63 : Put the timer forward

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details

- Corrects an error (earliness or lateness) of the timer due to the precision of subclock oscillation.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

int8_t cycle=-1;

void func(void)
{
	R_PG_Clock_Set(); // Set the clock.

	// Set up the RTC and start its counter.
	R_PG_RTC_Start();
}

void RtcPrdIntFunc(void)
{
	// Correct an error of the timer.
	R_PG_RTC_ManualErrorAdjust(cycle);
}
```

5.16.9 R_PG_RTC_Set24HourMode

Definition bool R_PG_RTC_Set24HourMode (void)

Description Places the RTC in 24-hour mode

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details

- Places the RTC in 24-hour mode.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_Clock_Set(); // Set the clock.

	// Set up the RTC and start its counter.
	R_PG_RTC_Start();

	// Set the current time (03:44:55 on November 22, 2000)
	R_PG_RTC_SetCurrentTime(
		0x55, // 55 seconds
		0x44, // 44 minutes
		0, // a.m.
		0x03, // 3 o'clock
		0x22, // 22rd
		0x11, // November
		0x2000 // 2000
	);

	// Places the RTC in 24-hour mode.
	R_PG_RTC_Set24HourMode();
}
```

5.16.10 R_PG_RTC_Set12HourMode

Definition: bool R_PG_RTC_Set12HourMode (void)

Description: Places the RTC in 12-hour mode

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:
- Places the RTC in 12-hour mode.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.

    // Set up the RTC and start its counter.
    R_PG_RTC_Start();

    // Set the current time (03:44:55 on November 22, 2000)
    R_PG_RTC_SetCurrentTime(
        0x55, // 55 seconds
        0x44, // 44 minutes
        0, // 24-hour mode
        0x03, // 3 o’clock
        0x22, // 22rd
        0x11, // November
        0x2000 // 2000
    );

    // Places the RTC in 12-hour mode.
    R_PG_RTC_Set12HourMode();
}
```

5.16.11 R_PG_RTC_AutoErrorAdjust_Enable

Definition	bool R_PG_RTC_AutoErrorAdjust_Enable (int8_t cycle)
Description	Enables automatic correction of errors of the timer
Conditions for output	Automatic correction of errors of the timer has been set up.

Parameter

int8_t cycle	Value (i.e. a number of subclock cycles) for use in correcting an error of the timer -63 to -1: Put the timer back 0 to 63: Put the timer forward

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_Control

Details
- Enables automatic correction of errors of the timer.
- Automatically corrects errors (earliness or lateness) of the timer due to the precision of subclock oscillation over each adjustment cycle selected through the GUI.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

int8_t cycle=-60;

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.

    // Set up the RTC and start its counter.
    R_PG_RTC_Start();

    // Enable automatic correction of errors of the timer.
    R_PG_RTC_AutoErrorAdjust_Enable(cycle);

    // Set the current time (03:44:55 on November 22, 2000)
    R_PG_RTC_SetCurrentTime(
        0x55, // 55 seconds
        0x44, // 44 minutes
        0, // a.m.
        0x03, // 3 o'clock
        0x22, // 22rd
        0x11, // November
        0x2000 // 2000
    );
}
```

5.16.12 R_PG_RTC_AutoErrorAdjust_Disable

Definition: bool R_PG_RTC_AutoErrorAdjust_Disable (void)

Description: Disables automatic correction of errors of the timer

Conditions for output: Automatic correction of errors of the timer has been set up.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:
- Disables automatic correction of errors of the timer.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

int8_t cycle=-60;

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.

    // Set up the RTC and start its counter.
    R_PG_RTC_Start();

    // Enable automatic correction of errors of the timer.
    R_PG_RTC_AutoErrorAdjust_Enable(cycle);

    // Set the current time (03:44:55 on November 22, 2000)
    R_PG_RTC_SetCurrentTime(
        0x55, // 55 seconds
        0x44, // 44 minutes
        0, // a.m.
        0x03, // 3 o'clock
        0x22, // 22rd
        0x11, // November
        0x2000 // 2000
    );
}

void func2(void)
{
    // Disable automatic correction of errors of the timer.
    R_PG_RTC_AutoErrorAdjust_Disable();
}
```

5.16.13 R_PG_RTC_AlarmControl

Definition
bool R_PG_RTC_AlarmControl
(bool sec_enable, bool min_enable, bool hour_enable, bool day_of_week_enable,
bool day_enable, bool month_enable, bool year_enable)

Description
Enables or disables alarms

Conditions for output
An alarm interrupt has been set up.

Parameter

bool sec_enable	Seconds alarm (1: enabled, 0: disabled)
bool min_enable	Minutes alarm (1: enabled, 0: disabled)
bool hour_enable	Hours alarm (1: enabled, 0: disabled)
bool day_of_week_enable	Day-of-the-week alarm (1: enabled, 0: disabled)
bool day_enable	Date alarm (1: enabled, 0: disabled)
bool month_enable	Month alarm (1: enabled, 0: disabled)
bool year_enable	Year alarm (1: enabled, 0: disabled)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_RTC.c

RPDL function
R_RTC_Control

Details
- Enables or disables the seconds, minutes, hours, day-of-the-week, date, month, or year alarms.

Example
Refer to the example of R_PG_RTC_SetCurrentTime.

5.16.14 R_PG_RTC_SetAlarmTime

Definition

bool R_PG_RTC_SetAlarmTime
(uint8_t seconds, uint8_t minutes, bool pm, uint8_t hours,
uint8_t day_of_week, uint8_t day, uint8_t month, uint16_t year)

Description

Sets the time for an alarm

Conditions for output

An alarm interrupt has been set up.

Parameter

uint8_t seconds	Seconds (valid range of values: 0x00 to 0x59, as BCD values)
uint8_t minutes	Minutes (valid range of values: 0x00 to 0x59, as BCD values)
bool pm	a.m./p.m. 0: a.m. 1: p.m.
uint8_t hours	Hours (valid range of values in 24-hour mode: 0x00 to 0x23, as BCD values; in 12-hour mode: 0x01 to 0x12, as BCD values)
uint8_t day_of_week	Day of the week (valid range of values: 0x00 for Sunday to 0x06 for Saturday) When 0xff is specified, the day of the week is figured out from the values for day, month, and year.
uint8_t day	Date (valid range of values: 0x01 to the number of days in the specified month, as BCD values)
uint8_t month	Month (valid range of values: 0x01 to 0x12, as BCD values)
uint16_t year	Year (valid range of values: 0x0000 to 0x9999, as BCD values)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output

R_PG_RTC.c

RPDL function

R_RTC_Control

Details

- Sets the time for an alarm.
- Specify valid values even for items that are not to be used for an alarm interrupt.
- In 24-hour mode, specify 0 for p.m.

Example

Refer to the example of R_PG_RTC_SetCurrentTime.

5.16.15 R_PG_RTC_SetPeriodicInterrupt

Definition: bool R_PG_RTC_SetPeriodicInterrupt (float frequency)

Description: Specifies the cycle for generating the cyclic interrupt

Conditions for output: The cyclic interrupt has been set up.

Parameter:

float frequency	Frequency for the interrupt (Hz; valid values: 0.5, 1, 2, 4, 16, 64, and 256)

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:

- Changes the cycle for generating the cyclic interrupt.

Example: The following settings have been made through the GUI.

- Setting up the cyclic interrupt.
- Specifying RtcPrdIntFunc as the cyclic interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter.
}

void RtcAlmIntFunc(void)
{
    // Cyclic interrupt processing

    R_PG_RTC_SetPeriodicInterrupt( 4 );   // Specify 1/4 second as the cycle for
                                          // generating the cyclic interrupt.
}
```

5.16.16 R_PG_RTC_ClockOut_Enable

Definition: bool R_PG_RTC_ClockOut_Enable (void)

Description: Enables the clock output

Conditions for output: Output of a 1-Hz clock signal from the RTCOUT pin has been enabled.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:
- Starts 1-Hz clock output from the RTCOUT pin.

Example: The following setting has been made through the GUI.
- Enable 1-Hz clock output from the RTCOUT pin.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter and the clock output.
}

void func2(void)
{
    R_PG_RTC_ClockOut_Disable();   // Stop the clock output.
}

void func3(void)
{
    R_PG_RTC_ClockOut_Enable();   // Restart the clock output.
}
```

5.16.17 R_PG_RTC_ClockOut_Disable

Definition: bool R_PG_RTC_ClockOut_Disable (void)

Description: Disables the clock output

Conditions for output: Output of a 1-Hz clock signal from the RTCOUT pin has been enabled.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_Control

Details:
- Stops 1-Hz clock output from the RTCOUT pin.

Example: The following setting has been made through the GUI.
- Enable 1-Hz clock output from the RTCOUT pin.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set(); // Set the clock.
    R_PG_RTC_Start(); // Set up the RTC and start its counter and the clock output.
}

void func2(void)
{
    R_PG_RTC_ClockOut_Disable();   // Stop the clock output.
}

void func3(void)
{
    R_PG_RTC_ClockOut_Enable();   // Restart the clock output.
}
```

5.16.18 R_PG_RTC_StartBinary

Definition bool R_PG_RTC_StartBinary (void)

Description Sets up the RTC and starts its counter (binary count mode)

Parameter

uint32_t count	Alarm count (valid range of values : 0x00000001 to 0xFFFFFFFF)
uint32_t mask	Alarm mask (valid range of values : f0x00000001 to 0xFFFFFFFF)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_CreateBinary

Details

- Sets up the alarm interrupt, cyclic interrupt and starts the RTC’s counter.
  Before calling this function, call R_PG_Clock_Set to set the clock.
- This function does not set the current time. When the alarm interrupt is to be used, call
- this function before R_PG_RTC_SetCurrentTimeBinary, which sets the current time.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    // Set the clock.
    R_PG_Clock_Set();

    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary( 0x0000FFFF, 0x0000FFFF );
}
```

5.16.19 R_PG_RTC_StopBinary

Definition: bool R_PG_RTC_StopBinary (void)

Description: Suspends counting by the RTC (binary count mode)

Parameter: None

Return value:

true	Counting was successfully suspended.
false	Suspension failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_ControlBinary

Details:

- Suspends counting by the RTC.
- To restart counting, call R_PG_RTC_RestartBInary.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    // Set the clock.
    R_PG_Clock_Set();

    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary( 0x0000FFFF, 0x0000FFFF );
}

void func2(void)
{
    R_PG_RTC_StopBinary ();   // Suspend counting.
}

void func3(void)
{
    R_PG_RTC_RestartBinary();   // Restart counting.
}
```

5.16.20 R_PG_RTC_RestartBInary

Definition bool R_PG_RTC_RestartBinary (void)

Description Restarts counting by the RTC (binary count mode)

Parameter None

Return value

true	Counting was successfully restarted.
false	Restarting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details

- Allows the RTC to restart counting that was suspended by R_PG_RTC_StopBinary.

Example Refer to the example of R_PG_RTC_StopBinary.

5.16.21 R_PG_RTC_SetCurrentTimeBinary

Definition bool R_PG_RTC_SetCurrentTimeBinary(uint32_t count)

Description Sets the current time (binary count mode)

Parameter

uint32_t count	Current count (valid range of values: 0x00000000 to 0xFFFFFFFF)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details
- Sets the current count.
- When this function is called during counting, counting is suspended while the current time is set and resumed on completion of the settings.

Example
The following settings have been made through the GUI.
- Set up an alarm interrupt.
- Specify RtcAlmIntFunc as the alarm interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    // Set the clock.
    R_PG_Clock_Set();

    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary( 0x0000FFFF, 0x0000FFFF );

    // Set the current count
    R_PG_RTC_SetCurrentTimeBinary( 0x00001000 );

    // Set the alarm count and mask
    R_PG_RTC_SetAlarmTime( 0x00002000, 0x0000FFFF);
};

void RtcAlmIntFunc(void)
{
     // Alarm interrupt processing
```

5.16.22 R_PG_RTC_GetStatusBinary

Definition
bool R_PG_RTC_GetStatusBinary
(uint32_t * count, uint32_t * alarm_count, uint32_t * alarm_mask
Bool * carry, bool * alarm, bool * period, bool * reset, bool * running)

Description
Acquires information on the current state of the RTC (binary count mode)

Parameter

uint32_t * count	Destination for storage of the current count
uint32_t * alarm_count	Destination for storage of the alarm count
uint32_t * alarm_mask	Destination for storage of the alarm mask
bool * carry	Destination for storage of the incrementation interrupt flag
bool * alarm	Destination for storage of the alarm interrupt flag
bool * period	Destination for storage of the cyclic interrupt flag
bool * reset	Destination for storage of the reset bit (0: normal operation, 1: resetting in progress)
bool * running	Destination for storage of the start bit (0: clock stopped, 1: clock operating)

Return value

t rue	Acquisition succeeded.
f alse	Acquisition failed.

File for output
R_PG_RTC.c

RPDL function
R_RTC_ReadBinary

Details
- Acquires information on the current state of the RTC.
- For the parameter that corresponds to each of the items you wish to acquire, specify the address where the value is to be stored. For the items you do not wish to acquire, on the other hand, specify 0.
- The interrupt flag is cleared within this function.
- When the value of the incrementation interrupt flag is 1, the current time will change while the information is being acquired. Read the value again in such cases.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    // Set the clock.
    R_PG_Clock_Set();
    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary(0x0000FFFF, 0x0000FFFF);
}

void func2(void)
{
    do{
        // Acquire the values of the current count and incrementation interrupt flag.
            R_PG_RTC_GetStatusBinary(
            &count,      // Current count
            0,           // Alarm count
            0,           // Alarm mask
            &carry,      // Incrementation interrupt flag
            0,           // Alarm interrupt flag
            0,           // Cyclic interrupt flag
            0,           // Reset bit
            0            // Start bit
```

```
                );
        } while( carry );
}
```

5.16.23 R_PG_RTC_ManualErrorAdjustBinary

Definition bool R_PG_RTC_ManualErrorAdjustBinary (int8_t cycle)

Description Corrects an error of the timer (binary count mode)

Parameter

int8_t cycle	Value (i.e. a number of subclock cycles) for use in correcting an error of the timer -63 to -1 : Put the timer back 0 to 63 : Put the timer forward

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details

- Corrects an error (earliness or lateness) of the timer due to the precision of subclock oscillation.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

int8_t cycle=-1;

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.

    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary(0x0000FFFF, 0x0000FFFF);
}

void RtcPrdIntFunc(void)
{
    // Correct an error of the timer.
    R_PG_RTC_ManualErrorAdjustBinary(cycle);
}
```

5.16.24 R_PG_RTC_AutoErrorAdjustBinary_Enable

Definition
bool R_PG_RTC_AutoErrorAdjustBinary_Enable (int8_t cycle, int8_t period)

Description
Enables automatic correction of errors of the timer (binary count mode)

Conditions for output
Automatic correction of errors of the timer has been set up.

Parameter

int8_t cycle	Value (i.e. a number of subclock cycles) for use in correcting an error of the timer -63 to -1: Put the timer back 0 to 63: Put the timer forward
int8_t period	Adjustment cycle for use in correcting an error of the timer 8 : Every 8 seconds, 32 : Every 32 seconds

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_RTC.c

RPDL function
R_RTC_ControlBinary

Details
- Enables automatic correction of errors of the timer.
- Automatically corrects errors (earliness or lateness) of the timer due to the precision of subclock oscillation over each adjustment cycle specified.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

int8_t cycle=-60;
int8_t period=32 ;

void func(void)
{
    R_PG_Clock_Set(); // Set the clock.

    // Set up the RTC and start its counter.
    R_PG_RTC_StartBinary(0x0000FFFF, 0x0000FFFF);

    // Enable automatic correction of errors of the timer.
    R_PG_RTC_AutoErrorAdjustBinary_Enable(cycle, period);

    // Set the current count
    R_PG_RTC_SetCurrentTimeBinary(0x00001000);
}

void func2(void)
{
    // Disable automatic correction of errors of the timer.
    R_PG_RTC_AutoErrorAdjust_Disable();
}
```

5.16.25 R_PG_RTC_AutoErrorAdjustBinary_Disable

Definition bool R_PG_RTC_AutoErrorAdjustBinary_Disable (void)

Description Disables automatic correction of errors of the timer (binary count mode)

Conditions for output Automatic correction of errors of the timer has been set up.

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details

- Disables automatic correction of errors of the timer.

Example Refer to the example of R_PG_RTC_AutoErrorAdjustBinary_Enable.

5.16.26 R_PG_RTC_SetAlarmTimeBinary

Definition bool R_PG_RTC_SetAlarmTimeBinary(uint32_t count, uint32_t mask)

Description Sets the time for an alarm (binary count mode)

Conditions for output An alarm interrupt has been set up.

Parameter

uint32_t count	Alarm count (valid range of values : 0x00000001 to 0xFFFFFFFF)
uint32_t mask	Alarm mask (valid range of values : f0x00000001 to 0xFFFFFFFF)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details

- Sets the count and mask for an alarm.

Example Refer to the example of R_PG_RTC_SetCurrentTimeBinary.

5.16.27 R_PG_RTC_SetPeriodicInterruptBinary

Definition: bool R_PG_RTC_SetPeriodicInterruptBinary (float frequency)

Description: Specifies the cycle for generating the cyclic interrupt (binary count mode)

Conditions for output: The cyclic interrupt has been set up.

Parameter

float frequency	Frequency for the interrupt (Hz; valid values: 0.5, 1, 2, 4, 16, 64, and 256)

Return value

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_RTC.c

RPDL function: R_RTC_ControlBinary

Details
- Changes the cycle for generating the cyclic interrupt.

Example

The following settings have been made through the GUI.

- Setting up the cyclic interrupt.
- Specifying RtcPrdIntFunc as the cyclic interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	// Set the clock.
	R_PG_Clock_Set();

	// Set up the RTC and start its counter.
	R_PG_RTC_StartBinary(0x0000FFFF, 0x0000FFFF);
}

void RtcAlmIntFunc(void)
{
	// Cyclic interrupt processing

	R_PG_RTC_SetPeriodicInterruptBinary( 4 );	// Specify 1/4 second as the cycle for
							// generating the cyclic interrupt.
}
```

5.16.28 R_PG_RTC_ClockOutBinary_Enable

Definition bool R_PG_RTC_ClockOutBinary_Enable (void)

Description Enables the clock output (binary count mode)

Conditions for output Output of clock signal from the RTCOUT pin has been enabled.

Parameter None

Return value

True	Setting was made correctly.
False	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details
- Starts clock output from the RTCOUT pin.

Example
The following setting has been made through the GUI.
- Enable specified clock output from the RTCOUT pin.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    // Set the clock.
    R_PG_Clock_Set();

    // Set up the RTC and start its counter and the clock output.
    R_PG_RTC_StartBinary(0x0000FFFF, 0x0000FFFF);
}

void func2(void)
{
    R_PG_RTC_ClockOutBinary_Disable();   // Stop the clock output.
}

void func3(void)
{
    R_PG_RTC_ClockOutBinary_Enable();   // Restart the clock output.
}
```

5.16.29 R_PG_RTC_ClockOutBinary_Disable

Definition bool R_PG_RTC_ClockOutBinary_Disable (void)

Description Disables the clock output (binary count mode)

Conditions for output Output of a clock signal from the RTCOUT pin has been enabled.

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_RTC.c

RPDL function R_RTC_ControlBinary

Details

- Stops clock output from the RTCOUT pin.

Example Refer to the example of R_PG_RTC_ClockOutBinary_Enable.

5.17 Independent Watchdog Timer (IWDTa)

5.17.1 R_PG_Timer_Start_IWDT

Definition: bool R_PG_Timer_Start_IWDT (void)

Description: Sets up the IWDT and starts its timer

Conditions for output: Register start mode is selected.
(This function is not output if auto-start mode is selected. A macro for setting option function select registers is output to R_PG_MCU_OFS.c.)

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_Timer_IWDT.c

RPDL function: R_IWDT_Set

Details:
- This function sets up the IWDT and starts its counter.
- Before calling this function, call R_PG_Clock_Set to set the clock.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func(void)
{
	//Set up the clocks
	R_PG_Clock_Set();

	//Sets up the IWDT and starts its timer
	R_PG_Timer_Start_IWDT();
}
```

5.17.2 R_PG_Timer_RefreshCounter_IWDT

Definition bool R_PG_Timer_RefreshCounter_IWDT (void)

Description Refresh the counter

Parameter None

Return value

true	Refreshing succeeded
false	Refreshing failed

File for output R_PG_Timer_IWDT.c

RPDL function R_IWDT_Control

Details

- Refreshes the IWDT counter
- After starting the count operation, call this function to clear the counter before the counter underflow.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func1(void)
{
	//Set up the clocks
	R_PG_Clock_Set();

	//Sets up the IWDT and starts its timer
	R_PG_Timer_Start_IWDT();
}

void func2(void)
{
	//Refresh the counter
	R_PG_Timer_RefreshCounter_IWDT();
}
```

5.17.3 R_PG_Timer_GetStatus_IWDT

Definition
bool R_PG_Timer_GetStatus_IWDT(uint16_t * counter_val, bool * undf, bool * ref_err)

Description
Acquires the status flag and count value of IWDT

Parameter

uint16_t * counter_val	The address of storage area for the IWDT counter value
bool * undf	The address of storage area for the underflow flag
bool * ref_err	The address of storage area for the refresh error flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output
R_PG_Timer_IWDT.c

RPDL function
R_IWDT_Read

Details
- Acquires the IWDT status flag and counter value.
- The underflow flag shall be cleared in this function.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

uint16_t counter_val;
bool undf;
bool ref_err;

void func(void)
{
    //Acquires the IWDT status flag and counter value
    R_PG_Timer_GetStatus_IWDT(&counter_val, &undf, &ref_err);
}
```

5.18 Serial Communications Interface (SCIe, SCIf)

5.18.1 R_PG_SCI_Set_C<*channel number*>

Definition
bool R_PG_SCI_Set_C<*channel number*> (void)
<*channel number*>: 1, 5, 6, 9, 12

Description
Set up a SCI channel

Parameter
None

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function
R_SCI_Create, R_SCI_Set

Details
- Releases a SCI channel from the module-stop state, makes initial settings.
- Function R_PG_Clock_Set must be called before calling this function.
- When the name of the notification function has been specified in the GUI, if corresponding event occurs, the function having the specified name will be called. Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.

Example
SCI1 has been set in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.
}
```

5.18.2 R_PG_SCI_SendTargetStationID_C<*channel number*>

Definition: bool R_PG_SCI_SendTargetStationID_C<*channel number*> (uint8_t id)

<*channel number*>: 1, 5, 6, 9, 12

Description: Transmits the ID code of the receiving station

Conditions for output:

- The function of transmission is selected for a SCI channel
- The multi-processer communications function is enabled in the asynchronous serial communication mode

Parameter:

uint8_t id	The ID to be transmitted (0 to 255)

Return value:

true	Transmission succeeded
false	Transmission failed

File for output: R_PG_SCI_C<*channel number*>.c

<*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Send

Details:

- Generates an ID transmission cycle to transmit the ID code of the destination receiving station.
- This function waits until the ID transmission cycle has been completed.

Example: A case where the setting is made as follows.

- The function of transmission is selected for a SCI1 channel
- The multi-processer communications function is enabled in the asynchronous serial communication mode
- “Wait at the transmission function until all data has been transmitted” is selected as the data transmission method.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[] = “ABCDEFGHIJ”;

void func(void)
{
	R_PG_Clock_Set();			//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();			//Set up SCI1
	R_PG_SCI_SendTargetStationID_C1( 5 );		//Send ID code (ID:5)
	R_PG_SCI_SendAllData_C1( data, 10 );		//Send data
}
```

5.18.3 R_PG_SCI_StartSending_C<*channel number*>

Definition
bool R_PG_SCI_StartSending_C<*channel number*> (uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description
Start the data transmission

Conditions for output
- The function of transmission is selected for a SCI channel in GUI.
- "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI.

Parameter

uint8_t * data	The start address of the data to be sent.
uint16_t count	The number of the data to be sent. Set this to 0 if the transmit data is a character string (ending with a null character).

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_SCI_C<*channel number*>.c　　<*channel number*>: 1, 5, 6, 9, 12

RPDL function
R_SCI_Send

Details
- This function starts the data transmission.
- This function is generated when "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI. This function returns immediately and the notification function having the specified name will be called when the last byte has been sent. Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- The number of transmitted data can be acquired by R_PG_SCI_GetSentDataCount_C <*channel number*>. The transmission can be terminated by calling R_PG_SCI_StopCommunication_C<*channel number*> before all bytes have been sent.
- The count of transmitted characters will loop back to 0 if 65536 characters are sent.

Example
SCI1 has been set as transmitter in the GUI.
Sci1TrFunc was specified as the name of the transmit end notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
    R_PG_Clock_Set();               //The clock-generation circuit has to be set first.
    R_PG_SCI_Set_C1();              //Set up SCI1.
    R_PG_SCI_StartSending_C1(data, 255);        //Send 255 bytes of binary data.
}

//Transmit end notification function that called when all bytes have been sent
void Sci1TrFunc(void)
{
    R_PG_SCI_StopModule_C1();           //Shut down the SCI1
}
```

5.18.4 R_PG_SCI_SendAllData_C<*channel number*>

Definition bool R_PG_SCI_SendAllData_C<*channel number*> (uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description Transmit all data

Conditions for output
- The function of transmission is selected for a SCI channel in GUI.
- Other than "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI.

Parameter

uint8_t * data	The start address of the data to be sent.
uint16_t count	The number of the data to be sent. Set this to 0 if the transmit data is a character string (ending with a null character).

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function R_SCI_Send

Details
- This function transmits all data.
- This function is generated when other than "Notify the transmission completion of all data by function call" is selected as the transmission method in GUI. This function waits until the last byte has been sent.
- The count of transmitted characters will loop back to 0 if 65536 characters are sent.

Example SCI1 has been set as transmitter in the GUI.
"Wait at the transmission function until the last byte has been transmitted" is selected as the transmission method in GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
        R_PG_Clock_Set();               //The clock-generation circuit has to be set first.
        R_PG_SCI_Set_C1();              //Set up SCI1.
        R_PG_SCI_SendAllData_C1(data, 255);             //Send 255 bytes of binary data.
        R_PG_SCI_StopModule_C1();               //Shut down the SCI1
}
```

5.18.5 R_PG_SCI_I2CMode_Send_C<*channel number*>

Definition

bool R_PG_SCI_I2CMode_Send_C<*channel number*>
(bool addr_10bit, uint16_t slave, uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description

Transmit data by simple I^{2}C bus interface

Conditions for output

- Simple I^{2}C bus interface is selected for “Mode”.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Slave address
uint8_t * data	The start address of the data to be sent
uint16_t count	The number of the data to be sent

Return value

true	When [Wait at the transmission function until all data has been transmitted] was selected for data transmission method, the operation completed OK. When except [Wait at the transmission function until all data has been transmitted] is selected for data transmission method, return value is always “true”.
false	When [Wait at the transmission function until all data has been transmitted] was selected for data transmission method, an error was detected.

File for output

R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function

R_SCI_IIC_Write

Details

- Transmit data by simple I^{2}C bus interface.

Example

[SCI1]
Mode: Simple I2C mode
Data transmission method: Notify the transmission completion of all data by function call

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_tr[] = “ABCDEFGHIJ”;
uint16_t tr_count;

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.

	//Transmit data by simple I2C bus interface
	R_PG_SCI_I2CMode_Send_C1(0, 0x0006, data_tr, 10);
}

void Sci1TrFunc(void)
{
	//Acquire the number of transmitted data
	R_PG_SCI_GetSentDataCount_C1(&tr_count);
}
```

5.18.6 R_PG_SCI_I2CMode_SendWithoutStop_C<*channel number*>

Definition

bool R_PG_SCI_I2CMode_SendWithoutStop_C<*channel number*>
(bool addr_10bit, uint16_t slave, uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description

Transmit data by simple I^2C bus interface (no stop condition)

Conditions for output

- Simple I^2C bus interface is selected for “Mode”.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Slave address
uint8_t * data	The start address of the data to be sent
uint16_t count	The number of the data to be sent

Return value

true	When [Wait at the transmission function until all data has been transmitted] was selected for data transmission method, the operation completed OK. When except [Wait at the transmission function until all data has been transmitted] is selected for data transmission method, return value is always “true”.
false	When [Wait at the transmission function until all data has been transmitted] was selected for data transmission method, an error was detected.

File for output

R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function

R_SCI_IIC_Write

Details

- Transmit data by simple I^2C bus interface (no stop condition).

Example

[SCI1]
Mode: Simple I2C mode
Data transmission method: Notify the transmission completion of all data by function call

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_tr[10];
uint8_t data_re[10];

void func(void)
{
	R_PG_Clock_Set();	//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();	//Set up SCI1.

	//Transmit data by simple I2C bus interface (no stop condition)
	R_PG_SCI_I2CMode_SendWithoutStop_C1(0, 0x0006, data_tr, 10);
}

void Sci1TrFunc(void)
{
	//Receive data by simple I2C bus interface (RE-START condition)
	R_PG_SCI_I2CMode_RestartReceive_C1(0, 0x0006, data_re, 10);
}
```

5.18.7 R_PG_SCI_I2CMode_GenerateStopCondition_C<*channel number*>

Definition: bool R_PG_SCI_I2CMode_GenerateStopCondition_C<*channel number*> (void)
<*channel number*>: 1, 5, 6, 9, 12

Description: Generate a stop condition

Conditions for output:
- Simple I²C bus interface is selected for “Mode”.

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Control

Details:
- This function generates a stop condition.

Example:
[SCI1]
Mode: Simple I2C mode
Data transmission method: Transfer the transmitted serial data by DMAC

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_tr[]=”ABCDEFGHIJ”;

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.

	//Set up a DMAC channel
	R_PG_DMAC_Set_C0();

	//Set the source address
	R_PG_DMAC_SetSrcAddress_C0(data_tr);

	//Make the DMAC be ready for the start trigger
	R_PG_DMAC_Activate_C0();

	//Set up a SCI channel
	R_PG_SCI_Set_C1();

	//Transmit data by simple I2C bus interface
	R_PG_SCI_I2CMode_Send_C1(0, 0x0006, data_tr, 10);
}

void Dmac0IntFunc(void)
{
	//Generate a stop condition
	R_PG_SCI_I2CMode_GenerateStopCondition_C1();
}
```

5.18.8 R_PG_SCI_I2CMode_Receive_C<*channel number*>

Definition
bool R_PG_SCI_I2CMode_Receive_C<*channel number*>
(bool addr_10bit, uint16_t slave, uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description
Receive data by simple I²C bus interface

Conditions for output
- Simple I²C bus interface is selected for “Mode”.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Slave address
uint8_t * data	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be received.

Return value

true	When [Wait at the reception function until all data has been received] was selected for data reception method, the operation completed OK. When except [Wait at the reception function until all data has been received] is selected for data reception method, return value is always “true”.
false	When [Wait at the reception function until all data has been received] was selected for data reception method, an error was detected.

File for output
R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function
R_SCI_IIC_Read

Details
- This function receives data by simple I²C bus interface.

Example
[SCI1]
Mode: Simple I2C mode
Function selection: Transmission and reception

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_re[10];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.

	R_PG_SCI_Set_C1();		//Set up SCI1.

	//Receive data by simple I2C bus interface
	R_PG_SCI_I2CMode_Receive_C1(0, 0x0006, data_re, 10);
}
```

5.18.9 R_PG_SCI_I2CMode_RestartReceive_C<*channel number*>

Definition	bool R_PG_SCI_I2CMode_RestartReceive_C<*channel number*> (bool addr_10bit, uint16_t slave, uint8_t * data, uint16_t count) <*channel number*>: 1, 5, 6, 9, 12
Description	Receive data by simple I^{2}C bus interface (RE-START condition)
Conditions for output	• Simple I^{2}C bus interface is selected for “Mode”.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Slave address
uint8_t * data	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be received.

Return value

true	When [Wait at the reception function until all data has been received] was selected for data reception method, the operation completed OK. When except [Wait at the reception function until all data has been received] is selected for data reception method, return value is always “true”.
false	When [Wait at the reception function until all data has been received] was selected for data reception method, an error was detected.

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_IIC_Read
Details	• This function receives data by simple I^{2}C bus interface. (RE-START condition)
Example	[SCI1] Mode: Simple I2C mode

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_re[10];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.

	R_PG_SCI_Set_C1();		//Set up SCI1.

	//Transmit data by simple I2C bus interface (no stop condition)
	R_PG_SCI_I2CMode_SendWithoutStop_C1(
		1,			//10 bit address format
		0x0006,			//Slave address
		PDL_NO_PTR,		//The start address of the data to be sent
		PDL_NO_DATA		//The number of the data to be sent
	);

	//Receive data by simple I2C bus interface (RE-START condition)
	R_PG_SCI_I2CMode_RestartReceive_C1(
		0,		//7 bit address format
		0x00f0,		//Slave address
		data_re,	//The start address of the storage area for the expected data.
		10		//The number of the data to be received.
```

```
    );
}
```

5.18.10 R_PG_SCI_I2CMode_ReceiveLast_C<*channel number*>

Definition
bool R_PG_SCI_I2CMode_ReceiveLast_C<*channel number*> (uint8_t * data)
<*channel number*>: 1, 5, 6, 9, 12

Description
Making reception complete in simple I^{2}C bus interface

Conditions for output
- Simple I^{2}C bus interface is selected for “Mode”.
- “Transfer the received serial data by DMAC” or “Transfer the received serial data by DTC” is selected for data reception method.

Parameter

uint8_t * data	The start address of the storage area for the expected data.

Return value

true	Setting was made correctly
false	Setting failed

File for output
R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function
R_SCI_IIC_ReadLastByte

Details
- After received data is transferred by the DMAC or DTC in simple I^{2}C mode, this function must be called to complete the reception.
- This function must be called from a DMA interrupt notification function or receive end notification function.

Example
[SCI1]
Mode: Simple I2C mode
Data reception method: Transfer the received serial data by DMAC
[DMAC0]
Transfer request source: RXI1 (SCI1 receive data full interrupt)
Transfer mode: Normal transfer mode
Length of a single data: 1 byte
Number of times: 4
Start address: 8a005h
Notify DMA interrupt (DMACIn)
[DMAC1]
Transfer request source: TXI1 (SCI1 transmit data empty interrupt)
Transfer mode: Normal transfer mode
Length of a single data: 1 byte
Number of times: 3
Source address update mode: Fixed
Start address: 8a003h

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_re[5];
uint8_t dummy_data=0xFF;

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.

	R_PG_SCI_Set_C1();		//Set up SCI1.
```

```
	R_PG_DMAC_Set_C0();	//Set up DMAC.
	R_PG_DMAC_Set_C1();	//Set up DMAC.
	R_PG_DMAC_SetDestAddress_C0(data_re);	//Set the destination address.
	R_PG_DMAC_SetSrcAddress_C1(&dummy_data);	//Set the source address.
	R_PG_DMAC_Active_C0();	//Make the DMAC be ready for the start trigger.
	R_PG_DMAC_Active_C1();	//Make the DMAC be ready for the start trigger.

	//Receive data by simple I2C bus interface.
	R_PG_SCI_I2CMode_Receive_C1(0, 0x0006, PDL_NO_PTR, 0);
}

void Dmac0IntFunc(void)
{
	//Making reception complete in simple I2C bus interface.
	R_PG_SCI_I2CMode_ReceiveLast_C1(&data_re[4]);
}
```

5.18.11 R_PG_SCI_I2CMode_GetEvent_C<*channel number*>

Definition	bool R_PG_SCI_I2CMode_GetEvent_C<*channel number*> (bool * nack) <*channel number*>: 1, 5, 6, 9, 12
Description	Get the detected event in the simple I^2C mode
Conditions for output	Simple I^2C bus interface is selected for “Mode”.

Parameter

bool * nack	The address of the storage area for a NACK detection flag.

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_GetStatus
Details	• This function acquires ACK Reception Data Flag in the simple I^2C mode.
Example	[SCI1] Mode:Simple I^2C mode Data transmission method:Notify the transmission completion of all data by function call

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_tr[]=”ABCDEFGHIJ”;
bool nack;

void func(void)
{
	R_PG_Clock_Set();             //The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();              //Set up SCI1.

	//Transmit data by simple I2C bus interface
	R_PG_SCI_I2CMode_Send_C1(0, 0x0006, data_tr, 10);
}

void Sci1TrFunc(void)
{
	//Get the detected event in the simple I2C mode
	R_PG_SCI_I2CMode_GetEvent_C1(&nack);
}
```

5.18.12 R_PG_SCI_SPIMode_Transfer_C<*channel number*>

Definition

bool R_PG_SCI_SPIMode_Transfer_C<*channel number*>
(uint8_t * tx_start, uint8_t * rx_start, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description

Transmit data by simple SPI mode

Conditions for output

- Simple SPI mode is selected for "Mode".

Parameter

uint8_t * tx_start	The start address of the data to be transmitted.
uint8_t * rx_start	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be transferred.

Return value

true	When [Wait at the transmission/reception function until all data has been transmitted/received] was selected for data transmission/reception method, the operation completed OK. When except [Wait at the transmission/reception function until all data has been transmitted/received] is selected for data transmission/reception method, return value is always "true".
false	When [Wait at the transmission/reception function until all data has been transmitted/received] was selected for data transmission/reception method, an error was detected.

File for output

R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function

R_SCI_SPI_Transfer

Details

- This function transmits data by simple SPI mode.

Example

[SCI1]
Mode: Simple SPI mode
Function selection: Transmission and reception

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_tr[10];
uint8_t data_re[10];

void func1(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.
}

void func2(void)
{
	//Transmit data by simple SPI mode
	R_PG_SCI_SPIMode_Transfer_C1(data_tr, data_re, 10);
}
```

5.18.13 R_PG_SCI_SPIMode_GetErrorFlag_C<*channel number*>

Definition	bool R_PG_SCI_SPIMode_GetErrorFlag_C<*channel number*> (bool * overrun) <*channel number*>: 1, 5, 6, 9, 12
Description	Get the serial reception error flag in the simple SPI mode
Conditions for output	Simple SPI mode is selected for “Mode”.

Parameter

bool * overrun	The address of the storage area for the overrun error flag.

Return value

true	Acquisition of the flag succeeded
false	Acquisition of the flag failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_GetStatus

Details

- This function acquires the serial reception error flag in the simple SPI mode.
- Specify 0 for a flag that is not required.
- The flags of detected error will be set to 1.

Example

[SCI1]

Mode: Simple SPI mode

Function selection: Transmission and reception

Notify receive error detection by function call

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t tx_data[4];
uint8_t rx_data[4];
bool overrun;

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.

	//Transmit data by simple SPI mode
	R_PG_SCI_SPIMode_Transfer_C1(tx_data, rx_data, 4);
}

void Sci1ErFunc(void)
{
	//Get the serial reception error flag in the simple SPI mode
	R_PG_SCI_SPIMode_GetErrorFlag_C1(&overrun);
}
```

5.18.14 R_PG_SCI_GetSentDataCount_C<*channel number*>

Definition	bool R_PG_SCI_GetSentDataCount_C<*channel number*> (uint16_t * count) <*channel number*>: 1, 5, 6, 9, 12
Description	Acquire the number of transmitted data
Conditions for output	The function of transmission is selected for a SCI channel and "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI.

Parameter

uint16_t * count	The storage location for the number of bytes that have been transmitted in the current transmission.

Return value

true	Acquisition of the data count succeeded
false	Acquisition of the data count failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_GetStatus
Details	• When "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI, the number of transmitted data can be acquired by calling this function.
Example	SCI1 has been set as transmitter in the GUI. Sci1TrFunc was specified as the name of the transmit end notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.
	R_PG_SCI_StartSending_C1(data, 255);		//Send 255 bytes of binary data.
}

//The transmit end notification function that called when all bytes have been sent
void Sci1TrFunc(void)
{
	R_PG_SCI_StopModule_C1();	//Shut down the SCI1
}

//The function to check the number of transmitted data and terminate the transmission
void func_terminate_SCI(void)
{
	uint16_t count;

	// Acquire the number of transmitted data
	R_PG_SCI_GetSentDataCount_C1(&count);

	if( count > 32 ){
		R_PG_SCI_StopCommunication_C1();	//Terminate the transmission
	}
}
```

5.18.15 R_PG_SCI_ReceiveStationID_C<*channel number*>

Definition	bool R_PG_SCI_ReceiveStationID_C<*channel number*> (void) <*channel number*>: 1, 5, 6, 9, 12
Description	Receives the ID code matches the ID of the receiving station itself
Conditions for output	• The function of reception is selected for a SCI channel • The multi-processer communications function is enabled in the asynchronous serial communication mode
Parameter	None
Return value	

true	Reception succeeded
false	Reception failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_Receive
Details	• This function waits until the ID code matches the ID of the receiving station itself has been received.
Example	A case where the setting is made as follows. • The function of reception is selected for a SCI1 channel • The multi-processer communications function is enabled in the asynchronous serial communication mode • "Notify the reception completion of all data by function call" is selected as the data reception method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[10];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1
	R_PG_SCI_ReceiveStationID_C1();		//Wait an ID reception
	R_PG_SCI_ReceiveAllData_C1( data, 10 );		//Start receiving
}
```

5.18.16 R_PG_SCI_StartReceiving_C<*channel number*>

Definition: bool R_PG_SCI_StartReceiving_C<*channel number*> (uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description: Start the data reception

Conditions for output:
- The function of reception is selected for a SCI channel in GUI
- "Notify the reception completion of all data by function call" is selected as the data reception method in GUI

Parameter:

uint8_t * data	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be received.

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Receive

Details:
- This function starts the data reception.
- This function is generated when "Notify the reception completion of all data by function call" is selected as the data reception method in GUI. This function returns immediately and the notification function having the specified name will be called when the last byte has been received. Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- The number of received data can be acquired by R_PG_SCI_GetReceivedDataCount_C <*channel number*>. The reception can be terminated by calling R_PG_SCI_StopReceiving_C<*channel number*> before all bytes have been received.
- The maximum number of characters to be received is 65535.

Example:
• SCI1 has been set as receiver in the GUI.
• Sci1ReFunc was specified as the name of the receive end notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
	R_PG_Clock_Set();			//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();			//Set up SCI1.
	R_PG_SCI_StartReceiving_C1(data, 255);	//Receive 255 bytes of binary data.
}

//Receive end notification function that called when all bytes have been received
void Sci1ReFunc(void)
{
	R_PG_SCI_StopModule_C1();	//Shut down the SCI1
}
```

5.18.17 R_PG_SCI_ReceiveAllData_C<*channel number*>

Definition: bool R_PG_SCI_ReceiveAllData_C<*channel number*> (uint8_t * data, uint16_t count)
<*channel number*>: 1, 5, 6, 9, 12

Description: Receive all data

Conditions for output:
- The function of reception is selected for a SCI channel in GUI.
- Other than "Notify the reception completion of all data by function call" is selected as the data reception method in GUI

Parameter:

uint8_t * data	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be received.

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Receive

Details:
- This function receives all data.
- This function is generated when other than "Notify the reception completion of all data by function call" is selected as the data reception method in GUI. This function waits until the last byte has been received.
- The maximum number of characters to be received is 65535.

Example: SCI1 has been set as receiver in the GUI.
"Wait at the reception function until all data has been transmitted" is selected as the reception method in GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
        R_PG_Clock_Set();              //The clock-generation circuit has to be set first.
        R_PG_SCI_Set_C1();             //Set up SCI1.
        R_PG_SCI_ReceiveAllData_C1(data, 255);            //Receive 255 bytes of binary
data.
        R_PG_SCI_StopModule_C1();             //Shut down the SCI1
}
```

5.18.18 R_PG_SCI_ControlClockOutput_C<*channel number*>

Definition	bool R_PG_SCI_ControlClockOutput_C<*channel number*> (bool output_enable) <*channel number*>: 1, 5, 6, 9, 12
Description	Control the output from the SCKn pin (n: 1, 5, 6, 9, or 12)
Conditions for output	• "Smart card interface mode" is selected for mode. • "Enable (GSM mode)" is selected for GSM mode. • "Output fixed high" or "Output fixed low" is selected for SCKn pin function.

Parameter

bool output_enable	Output from the SCKn pin (1: Clock output, 0: Output fixed)

Return value

true	Setting was made correctly
false	Setting failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_Control
Details	• This function controls the clock output from the SCKn pin.

Example

[SCI1]

Mode: Smart card interface mode

GSM mode: Enable

SCKn pin function: Output fixed high

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.

	R_PG_SCI_Set_C1();		//Set up SCI1.

	//Control the output from the SCKn pin
	R_PG_SCI_ControlClockOutput_C1( 1 );
}
```

5.18.19 R_PG_SCI_StopCommunication_C<*channel number*>

Definition R_PG_SCI_StopCommunication_C<*channel number*> (void)

<*channel number*>: 1, 5, 6, 9, 12

Description Stop transmission and reception of serial data

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_SCI_C<*channel number*>.c

<*channel number*>: 1, 5, 6, 9, 12

RPDL function R_SCI_Control

Details

- This function stops data transmission and reception.
- When "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI, the reception can be terminated by calling this function before the number of bytes specified at R_PG_SCI_StartSending_C<*channel number*> have been received.
- When "Notify the reception completion of all data by function call" is selected as the data reception method in GUI, the reception can be terminated by calling this function before the number of bytes specified at R_PG_SCI_StartReceiving_C<*channel number*> have been received.

Example Refer to the example of R_PG_SCI_GetSentDataCount_C<*channel number*>

5.18.20 R_PG_SCI_GetReceivedDataCount_C<*channel number*>

Definition	bool R_PG_SCI_GetReceivedDataCount_C<*channel number*> (uint16_t * count) <*channel number*>: 1, 5, 6, 9, 12
Description	Acquire the number of received data
Conditions for output	The function of reception is selected for a SCI channel and "Notify the reception completion of all data by function call" is selected as the data reception method in GUI.

Parameter

uint16_t * count	The storage location for the number of bytes that have been received in the current reception process.

Return value

true	Acquisition of the data count succeeded
false	Acquisition of the data count failed

File for output	R_PG_SCI_C<*channel number*>.c <*channel number*>: 1, 5, 6, 9, 12
RPDL function	R_SCI_GetStatus
Details	• When " Notify the reception completion of all data by function call " is selected as the receive end notification in GUI, the number of received data can be acquired by calling this function.
Example	SCI1 has been set as receiver in the GUI. Sci1ReFunc was specified as the name of the receive end notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.
	R_PG_SCI_StartReceiving_C1(data, 255);		//Receive 255 bytes of binary data.
}

//The receive end notification function that called when all bytes have been received.
void Sci1ReFunc(void)
{
	R_PG_SCI_StopModule_C1();	//Shut down the SCI1
}

//The function to check the number of received data and terminate the reception
void func_terminate_SCI(void)
{
	uint16_t count;

	//Acquire the number of received data
	R_PG_SCI_GetReceivedDataCount_C1(&count);

	if( count > 32 ){
		R_PG_SCI_StopCommunication_C1();	//Terminate the reception
	}
}
```

5.18.21 R_PG_SCI_GetReceptionErrorFlag_C<*channel number*>

Definition
: bool R_PG_SCI_GetReceptionErrorFlag_C<*channel number*>
(bool * parity, bool * framing, bool * overrun)
<*channel number*>: 1, 5, 6, 9, 12

Description
: Get the serial reception error flag

Conditions for output
: The function of reception is selected for a SCI channel

Parameter

bool * parity	The address of storage area for the parity error flag
bool * framing	The address of storage area for the framing error flag
bool * overrun	The address of storage area for the overrun error flag

Return value

true	Acquisition of the flags succeeded
false	Acquisition of the flags failed

File for output
: R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function
: R_SCI_GetStatus

Details
- This function acquires the reception error flags.
- Specify the address of storage area for the flags to be acquired.
- Specify 0 for a flag that is not required.
- The flags of detected error will be set to 1.

Example
SCI1 has been set as receiver in the GUI.
Sci1ReFunc was specified as the name of the receive end notification function in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
	R_PG_Clock_Set();		//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();		//Set up SCI1.
	R_PG_SCI_StartReceiving_C1(data, 1);		//Receive 1bytes of binary data.
}

//The receive end notification function that called when all bytes have been received.
void Sci1ReFunc(void)
{
	// Acquire the reception error flags
	R_PG_SCI_GetReceptionErrorFlag_C1( &parity, &framing, & overrun );
}
```

5.18.22 R_PG_SCI_ClearReceptionErrorFlag_C<*channel number*>

Definition: bool R_PG_SCI_ClearReceptionErrorFlag_C<*channel number*> (void)
<*channel number*>: 1, 5, 6, 9, 12

Description: Clear the serial reception error flag

Conditions for output:
- “Asynchronous mode”, “Clock synchronous mode” or “Smart card interface mode” is selected for mode.
- “Reception” or “Transmission and reception” is selected for function selection.

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Control

Details:
- This function clears the serial reception error flag.

Example:
Mode: Asynchronous mode
Function selection: Reception
Data reception method: Notify the reception completion of all data by function call

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data_re[10];
bool parity, framing, overrun;

void func(void)
{
    R_PG_Clock_Set();            //The clock-generation circuit has to be set first.

    R_PG_SCI_Set_C1();           //Set up SCI1.

    //Start the data reception
    R_PG_SCI_StartReceiving_C1(data_re, 10);
}

void Sci1ReFunc(void)
{
    //Acquire the reception error flags
    R_PG_SCI_GetReceptionErrorFlag_C1(&parity, &framing, &overrun);

    //Clear the serial reception error flag
    R_PG_SCI_ClearReceptionErrorFlag_C1();
}
```

5.18.23 R_PG_SCI_GetTransmitStatus_C<*channel number*>

<u>Definition</u>

bool R_PG_SCI_GetTransmitStatus_C<*channel number*> (bool * complete)

<*channel number*>: 1, 5, 6, 9, 12

<u>Description</u>

Get the state of transmission

<u>Conditions for output</u>

The function of transmission is selected for a SCI channel

<u>Parameter</u>

bool * complete	The address of storage area for the transmission completion flag (0: Being transmitted 1:Complete)

<u>Return value</u>

true	Acquisition of the transmission status succeeded
false	Acquisition of the transmission status failed

<u>File for output</u>

R_PG_SCI_C<*channel number*>.c

<*channel number*>: 1, 5, 6, 9, 12

<u>RPDL function</u>

R_SCI_GetStatus

<u>Details</u>

- This function acquires the state of transmission.

<u>Example</u>

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool complete;

void func(void)
{
	//Get the state of transmission
	R_PG_SCI_GetTransmitStatus_C1( &complete );
}
```

5.18.24 R_PG_SCI_StopModule_C<*channel number*>

Definition: bool R_PG_SCI_StopModule_C<*channel number*> (void)
<*channel number*>: 1, 5, 6, 9, 12

Description: Shut down a SCI channel

Parameter: None

Return value:

true	Shutting down succeeded
false	Shutting down failed

File for output: R_PG_SCI_C<*channel number*>.c
<*channel number*>: 1, 5, 6, 9, 12

RPDL function: R_SCI_Destroy

Details:
- Stops a SCI channel and places it in the module-stop state.

Example: A case where the setting is made as follows.
- SCI1 has been set as receptor in the GUI.
- "Wait at the reception function until all data has been received" is selected as the data reception method instead of specifying the receive end notification function name in GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t data[255];

void func(void)
{
	R_PG_Clock_Set();			//The clock-generation circuit has to be set first.
	R_PG_SCI_Set_C1();			//Set up SCI1.
	R_PG_SCI_ReceiveAllData_C1(data, 255);	//Receive 255 bytes of binary data.
	R_PG_SCI_StopModule_C1();		//Shut down the SCI1
}
```

5.19 I²C Bus Interface (RIIC)

5.19.1 R_PG_I2C_Set_C<*channel number*>

Definition: bool R_PG_I2C_Set_C<*channel number*> (void)
<*channel number*>: 0

Description: Set up a I²C bus interface channel

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_Set, R_IIC_Create

Details:
- Releases an I²C bus interface channel from the module-stop state, makes initial settings.
- Function R_PG_Clock_Set must be called before any use of this function.

Example: RIIC0 has been set in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
        R_PG_Clock_Set();               //The clock-generation circuit has to be set first
        R_PG_I2C_Set_C0();          //Set up RIIC0
}
```

5.19.2 R_PG_I2C_MasterReceive_C<*channel number*>

Definition bool R_PG_I2C_MasterReceive_C<*channel number*>
(bool addr_10bit, uint16_t slave, uint8_t* data, uint16_t count) <*channel number*>: 0

Description Master data reception

Conditions for output The function of master is selected for an I^2C bus interface channel in GUI.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Target slave address
uint8_t* data	The start address of the storage area for the expected data.
uint16_t count	The number of the data to be received.

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_I2C_C<*channel number*>.c <*channel number*>: 0

RPDL function R_IIC_MasterReceive

Details

- This function reads data from slave module. The stop condition is generated when the specified number of data has been received and reception completes.
- If "Wait at the reception function until all data has been transmitted" is selected as the master reception method in GUI, this function waits until the last byte has been received.
- If "Notify the reception completion of all data by function call" is selected as the master reception method in GUI, this function returns immediately and the notification function having the specified name will be called when the last byte has been receive.
  Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- A Start condition will be generated automatically. If the previous transfer did not issue a stop condition, a repeated start condition will be generated.
- In the 7-bit address mode, [7:1] of specified slave address value will be output. In 10-bit address mode, [10:1] of specified slave address will be output.
  The number of received data can be aquired by R_PG_I2C_GetReceivedDataCount_C <*channel number*>.
- When using 10-bit address mode, select other than [Notify the reception completion of all data by function call] for master reception method in the GUI.

Example A case where the setting is made as follows.

- The function of master is selected for a RIIC0
- "Wait at the reception function until all data has been transmitted" is selected as the master reception method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint8_t iic_data[10];    //The storage area for the received data

void func(void)
{
    R_PG_Clock_Set();    //The clock-generation circuit has to be set first
    R_PG_I2C_Set_C0();    //Set up RIIC0
    R_PG_I2C_MasterReceive_C0(    //Master reception
        0,      //Slave address format
        6,      //Slave address
        iic_data,      // The start address of the storage area for the received data
        10      // The number of the data to be received
    );

    R_PG_I2C_StopModule_C0();    //Stop RIIC0
}
```

5.19.3 R_PG_I2C_MasterReceiveLast_C<*channel number*>

Definition
bool R_PG_I2C_MasterReceiveLast_C< *channel number* >
(uint8_t* data)
< *channel number* >: 0

Description
Complete a master reception process

Conditions for output
- The function of master is selected for an I^2C bus interface channel in GUI.
- Select DMAC or DTC transfer as a master reception method

Parameter

uint8_t* data	The address of the storage area for the expected data.

Return value

true	Setting was made correctly.
false	Setting failed.

File for output
R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function
R_IIC_MasterReceiveLast

Details
- This function is genetarted when [Transfer the received serial data by DMAC] or [Transfer the received serial data by DTC] is selected as a master reception method.
- In the master reception process that has used the DMAC or DTC transfer, NACK and
- stop condition will be issued by calling this function and the reception process will be terminated.
- To complete reception process when the DMAC or DTC transfer completes, call this function from DMAC or DTC interrupt notification function.
- Extra 1 byte is acquired from the receive data register in this function.
- The events that has been detected during the reception process or the received data count can be acquired by calling R_PG_I2C_GetEvent_Cn or R_PG_I2C_GetReceivedDataCount_Cn.

Example
A case where the setting is made as follows.
- "Transfer the received serial data by DMAC" is selected as the master reception method in RIIC0 setting.
- DMAC0 is set as follows
  Transfer request source : ICRXI0(receive data full interrupt of TIIC0)
  Transfer system : Single-operand transfer
  Unit data size : 1 byte
  Single operand data count : 1
  Total transfer data size : Number of dtat to be received by RIIC0
  Source start address : Address of RIIC0 received data register
  Destination start address : Destination address of the data transfer
  DMA interrupt notification fuction name : Dmac0IntFunc

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void Dmac0IntFunc(){
    uint8_t data; //Strage area of extra data

    //Isse NACK and STOP condition and complete the reception
    R_PG_I2C_MasterReceiveLast( &data );
```

```
}

void func(void)
{
     //The clock-generation circuit has to be set first
     R_PG_Clock_Set();

     //Set up RIIC0
     R_PG_I2C_Set_C0();

    //Set up the DMAC0
    R_PG_DMAC_Set_C0();

    //Activate the DMAC0
    R_PG_DMAC_Activate_C0();

     //Master reception
    R_PG_I2C_MasterReceive_C0(
        0,      //Slave address format
        6,      //Slave address
        PDL_NO_PTR, // For DMAC transfer, set PDL_NO_PTR
        10      // The number of the data (For DMAC transfer, set 0)
    );
}
```

5.19.4 R_PG_I2C_MasterSend_C<*channel number*>

Definition: bool R_PG_I2C_MasterSend_C<*channel number*>
(bool addr_10bit, uint16_t slave, uint8_t* data, uint16_t count) <*channel number*>: 0

Description: Master data transmission

Conditions for output: The function of master is selected for an I^2C bus interface channel in GUI.

Parameter:

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Target slave address
uint8_t* data	The start address of the data to be sent
uint16_t count	The number of the data to be sent

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_I2C_C<*channel number*>.c <*channel number*>: 0

RPDL function: R_IIC_MasterSend

Details:
- This function sends data to the slave module. The stop condition is generated when the specified number of data has been transmitted and transmission completes.
- If "Wait at the transmission function until all data has been transmitted" is selected as the data transmission method in GUI, this function waits until the last byte has been transmitted or other events are detected.
- If "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI, this function returns immediately and the notification function having the specified name will be called when the last byte has been transmitted. Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- A Start condition will be generated automatically. If the previous transfer did not issue a stop condition, a repeated start condition will be generated.
- In the 7-bit address mode, [7:1] of specified slave address value will be output. In 10-bit address mode, [10:1] of specified slave address will be output.
- The number of transmitted data can be aquired by R_PG_I2C_GetSentDataCount_C <*channel number*>.
- When using 10-bit address mode, select other than [Notify the transmission completion of all data by function call] for master transmission method in the GUI.

Example: A case where the setting is made as follows.
- The function of master is selected for a RIIC0
- "Wait at the transmission function until all data has been transmitted" is selected as the data transmission method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"
```

```
// The storage area for the data to be transmitted
uint8_t iic_data[10];

void func(void)
{
    //The clock-generation circuit has to be set first
    R_PG_Clock_Set();

    //Set up RIIC0
    R_PG_I2C_Set_C0();

    //Master transmission
    R_PG_I2C_MasterSend_C0(
        0,      //Slave address format
        6,      //Slave address
        iic_data,      // The start address of the storage area for the data to be transmitted
        10      // The number of the data to be transmitted
    );

    //Stop RIIC0
    R_PG_I2C_StopModule_C0();
}
```

5.19.5 R_PG_I2C_MasterSendWithoutStop_C*<channel number>*

Definition

bool R_PG_I2C_MasterSendWithoutStop_C*<channel number>*
(bool addr_10bit, uint16_t slave, uint8_t* data, uint16_t count) *<channel number>*: 0

Description

Master data transmission (No stop condition)

Conditions for output

The function of master is selected for an I^{2}C bus interface channel in GUI.

Parameter

bool addr_10bit	Slave address format (1: 10bit 0: 7bit)
uint16_t slave	Target slave address
uint8_t* data	The start address of the data to be sent
uint16_t count	The number of the data to be sent

Return value

true	Setting was made correctly.
false	Setting failed.

File for output

R_PG_I2C_C*<channel number>*.c
<channel number>: 0

RPDL function

R_IIC_MasterSend

Details

- This function sends data to the slave module. The stop condition will not be generated. To generate a stop condition, call R_PG_I2C_GenerateStopCondition_C*<channel number>*.
- If "Wait at the transmission function until all data has been transmitted" is selected as the data transmission method in GUI, this function waits until the last byte has been transmitted or other events are detected.
- If "Notify the transmission completion of all data by function call" is selected as the data transmission method in GUI, this function returns immediately and the notification function having the specified name will be called when the last byte has been transmitted. Create the notification function as follows:
  void *<name of the notification function>* (void)
- For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- A Start condition will be generated automatically. If the previous transfer did not issue a stop condition, a repeated start condition will be generated.
- In the 7-bit address mode, [7:1] of specified slave address value will be output. In 10-bit address mode, [10:1] of specified slave address will be output.
  The number of transmitted data can be aquired by R_PG_I2C_GetSentDataCount_C *<channel number>*.
- When using 10-bit address mode, select other than [Notify the transmission completion of all data by function call] for master transmission method in the GUI.

Example

A case where the setting is made as follows.

- The function of master is selected for a RIIC0
- "Notify the transmission completion of all data by function call" is selected as the data transmission method
- IIC0MasterTrFunc was specified as the name of the transmit end notification function

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[10];

void func(void)
{
	//The clock-generation circuit has to be set first
	R_PG_Clock_Set();

	//Set up RIIC0
	R_PG_I2C_Set_C0();

	//Master transmission
	R_PG_I2C_MasterSendWithoutStop_C0(
		0,	//Slave address format
		6,	//Slave address
		iic_data,	// The start address of the storage area for the data to be transmitted
		10	// The number of the data to be transmitted
	);
}

void IIC0MasterTrFunc(void){

	//Generate stop condition
	R_PG_I2C_GenerateStopCondition_C0();

	//Stop RIIC0
	R_PG_I2C_StopModule_C0();
}
```

5.19.6 R_PG_I2C_GenerateStopCondition_C<*channel number*>

Definition: bool R_PG_I2C_GenerateStopCondition_C<*channel number*> (void)
<*channel number*>: 0

Description: Generate a stop condition

Conditions for output: The function of master is selected for an I^2C bus interface channel in GUI.

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_Control

Details:
- This function generates a stop condition for the transmission started by R_PG_I2C_MasterSendWithoutStop_C<*channel number*>.

Example: RIIC0 has been set in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[10];

void func(void)
{
	//The clock-generation circuit has to be set first
	R_PG_Clock_Set();

	//Set up RIIC0
	R_PG_I2C_Set_C0();

	//Master transmission
	R_PG_I2C_MasterSendWithoutStop_C0(
		0,	//Slave address format
		6,	//Slave address
		iic_data,	// The start address of the storage area for the data to be transmitted
		10	// The number of the data to be transmitted
	);
}

void IIC0MasterTrFunc(void)
{
	//Generate stop condition
	R_PG_I2C_GenerateStopCondition_C0();

	//Stop RIIC0
	R_PG_I2C_StopModule_C0();
}
```

5.19.7 R_PG_I2C_GetBusState_C<*channel number*>

Definition: bool R_PG_I2C_GetBusState_C<*channel number*> (bool *busy)
<*channel number*>: 0

Description: Get the bus state

Conditions for output: The function of master is selected for an I^2C bus interface channel in GUI.

Parameter:

bool *busy	The address of storage area for the bus busy detection flag

Return value:

true	Acquisition of the flag succeeded
false	Acquisition of the flag failed

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_GetStatus

Details:

- This function acquires the bus busy detection flag.

Bus busy detection flag

0	The I^2C bus is released (bus free state)
1	The I^2C bus is occupied (bus busy state or in the bus free state)

Example: RIIC0 has been set in the GUI.

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[10];

//Storage for bus busy detection flag
uint8_t busy;

void func(void)
{
    //The clock-generation circuit has to be set first
    R_PG_Clock_Set();

    //Set up RIIC0
    R_PG_I2C_Set_C0();

    // Wait for the I2C bus to be free
    do{
        R_PG_I2C_GetBusState_C0( & busy );
    } while( busy );

    //Master transmission
    R_PG_I2C_MasterSend_C0(
        0,      //Slave address format
        6,      //Slave address
        iic_data,    // The start address of the storage area for the data to be transmitted
        10      // The number of the data to be transmitted
    );
```

5.19.8 R_PG_I2C_SlaveMonitor_C<*channel number*>

Definition: bool R_PG_I2C_SlaveMonitor_C<*channel number*> (uint8_t *data, uint16_t count)
<*channel number*>: 0

Description: Slave bus monitor

Conditions for output: The function of slave is selected for an I^2C bus interface channel in GUI.

Parameter

uint8_t* data	The start address of the received data
uint16_t count	The number of the data to be received

Return value

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_SlaveMonitor

Details

- This function monitors the accesses from master modules.
- If "Notify the reception completion of all data, slave read request, or a stop condition detection by function call" is selected as the slave monitor method in GUI, this function returns immediately and the notification function having the specified name will be called when a read access from master module or a stop condition is detected. Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.
- If "Wait at the monitor function until reception completion, slave read request, or a stop condition detection" is selected as the slave monitor method in GUI, this function waits until a read access from master module or a stop condition is detected.
- The received data from a master module is stored in the storage area of specified address. Specify the number of data to not exceed the size of storage area. If the number of the data from the master module exceeds the specified number, NACK shall be generated.
- The transmit/receive mode can be aquired by calling R_PG_I2C_GetRW_C<*channel number*>. The data can be transmitted by calling R_PG_I2C_SlaveSend_C<*channel number*> to respond to a transmission (read) request from the master.
- Call R_PG_I2C_GetDetectedAddress_C<*channel number*> to acquire a detected slave address. Call R_PG_I2C_GetEvent_C<*channel number*> to acquire the detected events (e.g. a stop condition or a start condition).
- When using 10-bit address mode, select other than [Notify the transmission completion of all data, slave read request, or a stop condition detection by function call] for slave monitor method in the GUI.

Example: A case where the setting is made as follows.

- The function of slave is selected for a RIIC0
- IIC0SlaveFunc was specified as the name of the slave monitor function

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be received
uint8_t iic_data_re[10];

// The storage area for the data to be transmitted (slave address 0)
uint8_t iic_data_tr_0[10];

// The storage area for the data to be transmitted (slave address 1)
uint8_t iic_data_tr_1[10];

//Storage for bus busy detection flag
uint8_t busy;

void func(void)
{
	//The clock-generation circuit has to be set first
	R_PG_Clock_Set();

	//Set up RIIC0
	R_PG_I2C_Set_C0();

	// Slave monitor
	R_PG_I2C_SlaveMonitor_C0(
		iic_data_re,	// The start address of the storage area for the received data
		10	//The number of the data to be received
	);
}

void IIC0SlaveFunc (void)
{
	bool transmit, start, stop;
	bool addr0, addr1;

	//Get the detected events
	R_PG_I2C_GetEvent_C0(0, &stop, &start, 0, 0);

	//Get an access type
	R_PG_I2C_GetTR_C0(&transmit);

	//Get a detected address
	R_PG_I2C_GetDetectedAddress_C0(&addr0, &addr1, 0, 0, 0, 0);

	if (start && transmit && address0) {
		R_PG_I2C_SlaveSend_C(
			iic_data_tr_0,
			10
		);
	}

	else if (start && read && address1) {
		R_PG_I2C_SlaveSend_C(
			iic_data_tr_1,
			10
		);
	}
}
```

5.19.9 R_PG_I2C_SlaveSend_C<*channel number*>

Definition — bool R_PG_I2C_SlaveSend_C<*channel number*> (uint8_t *data, uint16_t count)
<*channel number*>: 0

Description — Slave data transmission

Conditions for output — The function of slave is selected for an I^2C bus interface channel in GUI.

Parameter

uint8_t* data	The start address of the data to be transmitted
uint16_t count	The number of the data to be transmitted

Return value

true	Setting was made correctly.
false	Setting failed.

File for output — R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function — R_IIC_SlaveSend

Details
- This function transmits the data to the master module.
- If the master requires more data than is supplied, this function shall loop back to the start of the data.

Example — Refer to the example of R_PG_I2C_SlaveMonitor_C<*channel number*>

5.19.10 R_PG_I2C_GetDetectedAddress_C<*channel number*>

Definition
bool R_PG_I2C_GetDetectedAddress_C<*channel number*>
(bool *addr0, bool *addr1, bool *addr2, bool *general, bool *device, bool *host)
<*channel number*>: 0

Description
Get the detected address

Conditions for output
The function of slave is selected for an I^{2}C bus interface channel in GUI.

Parameter

bool *addr0	The address of storage area for slave address 0 detection flag
bool *addr1	The address of storage area for slave address1 detection flag
bool *addr2	The address of storage area for slave address 2 detection flag
bool *general	The address of storage area for general call address detection flag
bool *device	The address of storage area for device-ID command detection flag
bool *host	The address of storage area for host address detection flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output
R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function
R_IIC_GetStatus

Details
- This function acquires the detected address.
- Specify the address of storage area for the flags to be acquired.
- Specify 0 for a flag that is not required.
- 1 is set to detected address

Example
Refer to the example of R_PG_I2C_SlaveMonitor_C<*channel number*>

5.19.11 R_PG_I2C_GetTR_C<*channel number*>

Definition	bool R_PG_I2C_GetTR_PG_C<*channel number*> (bool * transmit) <*channel number*>: 0
Description	Get the transmit/receive mode
Conditions for output	The function of slave is selected for an I^2C bus interface channel in GUI.

Parameter

bool * transmit	The address of storage area for the transmit mode flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_GetStatus

Details
- This function acquires the detected address.
- Specify the address of storage area for the flags to be acquired.
- Specify 0 for a flag that is not required.
- 1 is set to detected address.
- This function acquires the the transmit/receive mode.

Transmit mode flag

0	Receive mode
1	Transmit mode

Example: Refer to the example of R_PG_I2C_SlaveMonitor_C<*channel number*>

5.19.12 R_PG_I2C_GetEvent_C<*channel number*>

Definition: bool R_PG_I2C_GetEvent_C<*channel number*>
(bool *nack, bool *stop, bool *start, bool *lost, bool *timeout)
<*channel number*>: 0

Description: Get the detected event

Parameter:

bool *nack	The address of storage area for a NACK detection flag
bool *stop	The address of storage area for a stop condition detection flag
bool *start	The address of storage area for a start condition detection flag
bool *lost	The address of storage area for an arbitration lost
bool *timeout	The address of storage area for a timeout detection

Return value:

true	Acquisition succeeded
false	Acquisition failed

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_GetStatus

Details:
- This function acquires the detected event.
- Specify 0 for a flag that is not required.
- 1 is set to detected event.

Example: Refer to the example of R_PG_I2C_SlaveMonitor_C<*channel number*>

5.19.13 R_PG_I2C_GetReceivedDataCount_C<*channel number*>

Definition: bool R_PG_I2C_GetReceivedDataCount_C<*channel number*> (uint16_t *count)
<*channel number*>: 0

Description: Acquires the count of received data

Parameter

uint16_t *count	The address of storage area for the number of bytes that have been received

Return value

true	Acquisition of the data count succeeded
false	Acquisition of the data count failed

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_GetStatus

Details
- This function acquires the number of bytes that have been received in the current reception process.

Example: A case where the setting is made as follows.
- The function of master is selected for a RIIC0
- "Notify the reception completion of all data by function call" is selected as the master reception method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be received
uint8_t iic_data[256];

// The storage area for the number of received data
uint16_t count;

void func(void)
{
	//The clock-generation circuit has to be set first
	R_PG_Clock_Set();

	//Set up RIIC0
	R_PG_I2C_Set_C0();

	//Master receive
	R_PG_I2C_MasterReceive_C0(
		0,	//Slave address format
		6,	//Slave address
		iic_data,	// The address of storage area for the data to be received
		256	//The number of data to be received
	);

	//Wait until 64 bytes have been received
	do{
		R_PG_I2C_GetReceivedDataCount_C0( &count );
	} while( count < 64 );
}
```

5.19.14 R_PG_I2C_GetSentDataCount_C<*channel number*>

Definition: bool R_PG_I2C_GetSentDataCount_C<*channel number*> (uint16_t *count)
<*channel number*>: 0

Description: Acquires the count of transmitted data

Parameter:

uint16_t *count	The address of storage area for the number of bytes that have been transmitted

Return value:

true	Acquisition of the data count succeeded
false	Acquisition of the data count failed

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_GetStatus

Details:

- This function acquires the number of data written in I^2C Bus Transmit Data Register (ICDRT).
- 0 is acquired when the number of transmission specified to the transmitting function is completed.

Example: A case where the setting is made as follows.

- The function of master is selected for a RIIC0
- "Notify the transmission completion of all data by function call" is selected as the data transmission method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[256];

// The storage area for the number of transmitted data
uint16_t count;

void func(void)
{
	//The clock-generation circuit has to be set first
	R_PG_Clock_Set();

	//Set up RIIC0
	R_PG_I2C_Set_C0();

	//Master send
	R_PG_I2C_MasterSend_C0(
		0,	//Slave address format
		6,	//Slave address
		iic_data,	// The address of storage area for the data to be transmitted
		256	//The number of data to be transmitted
	);

	//Wait until 64 bytes have been transmitted
	do{
		R_PG_I2C_GetSentDataCount_C0( &count );
	} while( count < 64 );
}
```

5.19.15 R_PG_I2C_Reset_C<*channel number*>

Definition: bool R_PG_I2C_Reset_C<*channel number*> (void)
<*channel number*>: 0

Description: Reset the bus

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_I2C_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_IIC_Control

Details:
- This function resets the module.
- The settings of the module are preserved.

Example: A case where the setting is made as follows.
- The function of master is selected for a RIIC0
- "Notify the transmission completion of all data by function call" is selected as the data transmission method
  IIC0MasterTrFunc was specified as the name of the transmit end notification function

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[256];

void func(void)
{
        //The clock-generation circuit has to be set first
        R_PG_Clock_Set();

        //Set up RIIC0
        R_PG_I2C_Set_C0();

        //Master send
        R_PG_I2C_MasterSend_C0(
                0,      //Slave address format
                6,      //Slave address
                iic_data,       // The address of storage area for the data to be transmitted
                10      //The number of data to be transmitted
        );
}

void IIC0MasterTrFunc(void)
{
        if ( error ){
                R_PG_I2C_Reset_C0();
        }
}
```

5.19.16 R_PG_I2C_StopModule_C<*channel number*>

Definition bool R_PG_I2C_StopModule_C<*channel number*> (void)

<*channel number*>: 0

Description Shut down the I^2C bus interface channel

Parameter None

Return value

true	Shutting down succeeded.
false	Shutting down failed.

File for output R_PG_I2C_C<*channel number*>.c

<*channel number*>: 0

RPDL function R_IIC_Destroy

Details

- Stops an I^2C bus interface channel and places it in the module-stop state.

Example A case where the setting is made as follows.

- The function of master is selected for a RIIC0
- "Wait at the reception function until all data has been transmitted" is selected as the master reception method

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

// The storage area for the data to be transmitted
uint8_t iic_data[256];

void func(void)
{
        //The clock-generation circuit has to be set first
        R_PG_Clock_Set();

        //Set up RIIC0
        R_PG_I2C_Set_C0();

        //Master receive
        R_PG_I2C_MasterReceive _C0(
                0,       //Slave address format
                6,       //Slave address
                iic_data,       // The address of storage area for the data to be received
                10      //The number of data to be received
        );

        //Stop the RIIC0
        R_PG_I2C_StopModule_C0();
}
```

5.20 Serial Peripheral Interface (RSPI)

5.20.1 R_PG_RSPI_Set_C<*channel number*>

Definition bool R_PG_RSPI_Set_C<*channel number*> (void)
<*channel number*>: 0

Description Set up a RSPI channel

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function R_SPI_Create

Details

- Releases a serial peripheral interface channel from the module-stop state, makes initial settings, and sets the pins to be used.
- Function R_PG_Clock_Set must be called before calling this function.
- The commands are not set in this function. To set the commands, call R_PG_RSPI_SetCommand_C<*channel number*>.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_Clock_Set();	//Set up the clocks
	R_PG_RSPI_Set_C0();	//Set up RSPI0
	R_PG_RSPI_SetCommand_C0();	//Set commands
}
```

5.20.2 R_PG_RSPI_SetCommand_C<*channel number*>

Definition bool R_PG_RSPI_SetCommand_C<*channel number*> (void)

<*channel number*>: 0

Description Set commands

Parameter None

Return value

true	Setting was made correctly
false	Setting failed

File for output R_PG_RSPI_C<*channel number*>.c

<*channel number*>: 0

RPDL function R_SPI_Command

Details
- Set RSPI commands registers.
- All commands set in GUI (maximum number of commands: 8) shall be set.

Example Refer to the example of R_PG_RSPI_Set_C<*channel number*>

5.20.3 R_PG_RSPI_StartTransfer_C<*channel number*>

Definition

Transmission and reception operations (Full-duplex synchronous serial communications)

bool R_PG_RSPI_StartTransfer_C<*channel number*>
(uint32_t * tx_start, uint32_t * rx_start, uint16_t sequence_loop_count)
<*channel number*>: 0

Serial communications consisting of only transmit operations

bool R_PG_RSPI_StartTransfer_C<*channel number*>
(uint32_t * tx_start, uint16_t sequence_loop_count)
<*channel number*>: 0

Description

Start the data transfer

Conditions for output

"Notify the transfer completion and the error detection by function call" has been selected as the transfer method.

Parameter

uint32_t * tx_start	The start address of the data to be transmitted.
uint32_t * rx_start	The start address of the storage area for the expected data.
uint16_t sequence_loop_count	The number of times that the command sequence will be executed

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function

R_SPI_Transfer

Details

- Starts the data transfer.
- This function is generated when "Notify the transfer completion and the error detection by function call" is selected as the data transfer method in GUI.
- This function returns immediately and the notification function having the specified name will be called when all commands are executed or error is detected.
  Create the notification function as follows:
  void <*name of the notification function*> (void)
  For the notification function, note the contents of this chapter end, Notes on Notification Functions.

Example

A case where the setting is made as follows.

- RSPI has been set to master mode
- "Notify the transfer completion and the error detection by function call" is selected as
- the transfer method
- rsi0_int_func is specified as a notification function name
- Number of commands: 1 Number of frames: 4
  Data lengh of command 0 is 8 bits

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

uint32_t tx_data[4] = { 0x11, 0x22, 0x33, 0x44 };
uint32_t rx_data[4] = { 0x00, 0x00, 0x00, 0x00 };
```

```
bool    over_run,    mode_fault,    parity_error;

void func(void)
{
        R_PG_Clock_Set();        //Set up the clocks
        R_PG_RSPI_Set_C0();        //Set up RSPI0
        R_PG_RSPI_SetCommand_C0();        //Set commands
        R_PG_RSPI_StartTransfer_C0( tx_data, rx_data, 1 ); //Transfe 4 frames * 8bits
}

void rsi0_int_func (void)
{
        R_PG_RSPI_GetError_C0(&over_run, &mode_fault, &parity_error); //Get error flags
        if( over_run || mode_fault || parity_error ){

                //Processing when an error is detected
        }
        R_PG_RSPI_StopModule_C0();
}
```

5.20.4 R_PG_RSPI_TransferAllData_C<*channel number*>

Definition

Transmission and reception operations (Full-duplex synchronous serial communications)

bool R_PG_RSPI_TransferAllData_C<*channel number*>
(uint32_t * tx_start, uint32_t * rx_start, uint16_t sequence_loop_count)
<*channel number*>: 0

Serial communications consisting of only transmit operations

bool R_PG_RSPI_TransferAllData_C<*channel number*>
(uint32_t * tx_start, uint16_t sequence_loop_count)
<*channel number*>: 0

The DTC/DMAC transfer is selected for the transfer method

bool R_PG_RSPI_TransferAllData_C<*channel number*>
(uint16_t sequence_loop_count)
<*channel number*>: 0

Description

Transfer all data

Conditions for output

Other than "Notify the transfer completion and the error detection by function call" has been selected as the transfer method.

Parameter

uint32_t * tx_start	The start address of the data to be transmitted.
uint32_t * rx_start	The start address of the storage area for the expected data.
uint16_t sequence_loop_count	The number of times that the command sequence will be executed

Return value

true	Setting was made correctly
false	Setting failed

File for output

R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function

R_SPI_Transfer

Details

- Transfers all data.
- This function is generated when other than "Notify the transfer completion and the error detection by function call" is selected as the transmission method in GUI.
- This function waits until all commands are executed.

Example

A case where the setting is made as follows.

- RSPI has been set to master mode.
- "Wait until transfer completion" is selected as the transfer method.
- Number of commands: 1 Number of frames: 4
- Data lengh of command 0 is 8 bits

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint32_t tx_data[4] = { 0x11, 0x22, 0x33, 0x44 };
uint32_t rx_data[4] = { 0x00, 0x00, 0x00, 0x00 };
bool    over_run,   mode_fault,   parity_error;

void func(void)
{
```

```
    R_PG_Clock_Set();        //Set up the clocks
    R_PG_RSPI_Set_C0();        //Set up RSPI0
    R_PG_RSPI_SetCommand_C0();        //Set commands
    R_PG_RSPI_TransferAllData_C0( tx_data, rx_data, 1 ); //Transfe 4 frames * 8bits

    R_PG_RSPI_GetError_C0(&over_run, &mode_fault, &parity_error); //Get error flags
    if( over_run || mode_fault || parity_error ){

        //Processing when an error is detected
    }
    R_PG_RSPI_StopModule_C0();
}
```

5.20.5 R_PG_RSPI_GetStatus_C<*channel number*>

Definition
: bool R_PG_RSPI_GetStatus_C<*channel number*> (bool * idle)
  <*channel number*>: 0

Description
: Acquire the transfer status

Parameter

bool * idle	The address of storage area for the idle flag (0: Idle state 1: Transfer state)

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output
: R_PG_RSPI_C<*channel number*>.c
  <*channel number*>: 0

RPDL function
: R_SPI_GetStatus

Details

- Acquires the transfer status.
- The error flags (the overrun error flag, the mode fault error flag, and the parity error flag) are cleared in this function. Call R_PG_RSPI_GetError_C<*channel number*> to acquire the error flags before calling this function if needed.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

bool idle;

void func(void)
{
        do{
            //Get the id
                R_PG_RSPI_GetStatus_C0( & idle );
        }while( idle );
}
```

5.20.6 R_PG_RSPI_GetError_C<*channel number*>

Definition bool R_PG_RSPI_GetError_C<*channel number*>
(bool * over_run, bool * mode_fault, bool * parity_error)
<*channel number*>: 0

Description Acquire the error flags

Parameter

bool * over_run	The address of storage area for the overrun error flag
bool * mode_fault	The address of storage area for the mode fault error flag
bool * parity_error	The address of storage area for the parity error flag

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function R_SPI_GetStatus

Details
- Acquires the error flags.
- Specify the address of storage area for the items to be acquired. Specify 0 for an item that is not required.
- The error flags shall be cleared in this function.

Example Refer to the example of R_PG_RSPI_StartTransfer_C<*channel number*>, R_PG_RSPI_TransferAllData_C<*channel number*>, and R_PG_RSPI_GetCommandStatus_C<*channel number*>

5.20.7 R_PG_RSPI_GetCommandStatus_C<*channel number*>

Definition
bool R_PG_RSPI_GetCommandStatus_C<*channel number*>
(uint8_t * current_command, uint8_t * error_command)
<*channel number*>: 0

Description
Acquire the command status

Conditions for output
A RSPI channel has been set to the master mode

Parameter

uint8_t * current_command	The address of storage area for the current command pointer value (0 to 7)
uint8_t * error_command	The address of storage area for the value of command pointer when an error is detected (0 to 7)

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output
R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function
R_SPI_GetStatus

Details
- Acquires the current command pointer value (0 to 7) and the value of command pointer when an error is detected (0 to 7).
- Specify the address of storage area for the items to be acquired. Specify 0 for an item that is not required.
- The error flags (the overrun error flag, the mode fault error flag, and the parity error flag) are cleared in this function. Call R_PG_RSPI_GetError_C<*channel number*> to acquire the error flags before calling this function if needed.

Example
A case where the setting is made as follows.
- RSPI has been set to the master mode

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

bool    over_run,    mode_fault,    parity_error;
uint8_t error_command;

void func(void)
{
        R_PG_RSPI_GetError_C0(&over_run, &mode_fault, &parity_error); //Get error flags
        if( over_run || mode_fault || parity_error ){
                R_PG_RSPI_GetCommandStatus_C0( 0, &error_command );

                // Processing when an error is detected
        }
}
```

5.20.8 R_PG_RSPI_LoopBack<*loopback mode*>_C<*channel number*>

Definition: bool R_PG_RSPI_LoopBack<*loopback mode*>_C<*channel number*> (void)
<*loopback mode*>: Direct, Reversed, Disable
<*channel number*>: 0

Description: Set loopback mode

Conditions for output: The loopback mode has been set

Parameter: None

Return value:

true	Setting was made correctly
false	Setting failed

File for output: R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_SPI_Control

Details:

- Sets or disables RSPI pins to loopback mode.
- By calling R_PG_RSPI_LoopBackDirect_C<*channel number*>, the input path and output path for the shift register are connected. (transmit data = receive data)
- By calling R_PG_RSPI_LoopBackReversed _C<*channel number*>, the reversed input path and output path for the shift register are connected. (reversed transmit data = receive data)
- By calling R_PG_RSPI_LoopBackDisable_C<*channel number*>, the loopback mode is disabled.

Example:

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

void func(void)
{
	R_PG_RSPI_LoopBackDirect_C0();	//Set loopback mode
}
```

5.20.9 R_PG_RSPI_StopModule_C<*channel number*>

Definition: bool R_PG_RSPI_StopModule_C<*channel number*> (void)
<*channel number*>: 0

Description: Shut down a RSPI channel

Parameter: None

Return value:

true	Shutting down succeeded
false	Shutting down failed

File for output: R_PG_RSPI_C<*channel number*>.c
<*channel number*>: 0

RPDL function: R_SPI_Destroy

Details:
- Stops RSPI channel and places it in the module-stop state.

Example: Refer to the example of R_PG_RSPI_StartTransfer_C<*channel number*> and R_PG_RSPI_TransferAllData_C<*channel number*>.

5.21 CRC Calculator (CRC)

5.21.1 R_PG_CRC_Set

Definition bool R_PG_CRC_Set(void)

Description Set up CRC calculator

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_CRC.c

RPDL function R_CRC_Create

Details

- Releases the CRC calculator from the module-stop state, makes initial settings.

Example

```
//Include “R_PG_<project name>.h” to use this function.
#include "R_PG_default.h"

uint16_t data;

void func(void)
{
	R_PG_CRC_Set();    //Set up the CRC calculator
	R_PG_CRC_InputData(0xf0);      // Write the payload data
	R_PG_CRC_InputData(0x8f);      // Write the first half of the CRC checksum
	R_PG_CRC_InputData(0x7f);      // Write the second half of the CRC checksum
	R_PG_CRC_GetResult(&data);      // Read the CRC calculation result
	R_PG_CRC_StopModule();      // Shutdown the CRC unit
}
```

5.21.2 R_PG_CRC_InputData

Definition bool R_PG_CRC_InputData (uint8_t data)

Description Input a data to CRC calculator

Parameter

uint8_t data	The data to be used for the calculation

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_CRC.c

RPDL function R_CRC_Write

Details

- This function writes the data into the CRC calculation register

Example Refer to the example of R_PG_CRC_Set.

5.21.3 R_PG_CRC_GetResult

Definition: bool R_PG_CRC_GetResult (uint16_t * data)

Description: Get the the result of calculation

Parameter

uint16_t * data	The address of the location where the result shall be stored.

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output: R_PG_CRC.c

RPDL function: R_CRC_Read

Details:

- This function acquires the the result of calculation

Example: Refer to the example of R_PG_CRC_Set.

5.21.4 R_PG_CRC_StopModule

Definition bool R_CRC_Destroy (uint16_t * data)

Description Shut down CRC calculator

Parameter None

Return value

true	Acquisition succeeded
false	Acquisition failed

File for output R_PG_CRC.c

RPDL function R_CRC_Destroy

Details
- Stops the CRC calculator and places it in the module-stop state.

Example Refer to the example of R_PG_CRC_Set.

5.22 12-Bit A/D Converter (S12ADb)

5.22.1 R_PG_ADC_12_Set_S12AD0

Definition bool R_PG_ADC_12_Set_S12AD0 (void)

Description Sets up the 12-bit A/D converter

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_ADC_12_S12AD0.c

RPDL function R_ADC_12_Set, R_ADC_12_CreateUnit, R_ADC_12_CreateChannel

Details

- Releases the 12-bit A/D converter from the module-stop state, makes initial settings, and places the converter in the conversion-start trigger-input wait state. When the software trigger is selected to start conversion, conversion is started by calling R_PG_ADC_12_StartConversionSW_S12AD0.
- Before calling this function, call R_PG_Clock_Set to set the clock.
- The A/D-conversion end interrupt is set in this function. When the name of the interrupt notification function has been specified in the GUI, the function having the specified name will be called when an interrupt request is conveyed to the CPU. Create the interrupt notification function as follows:

  void <name of the interrupt notification function> (void)

  For notes on interrupt notification functions, refer to “Notes on Notification Functions” provided at the end of this section.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
      R_PG_Clock_Set();               // The clock-generation circuit has to be set first.
      R_PG_ADC_12_Set_S12AD0();       // Set up the 12-bit A/D converter (S12AD0).
}
```

5.22.2 R_PG_ADC_12_StartConversionSW_S12AD0

Definition	bool R_PG_ADC_12_StartConversionSW_S12AD0(void)
Description	Starts A/D conversion (by a software trigger)
Conditions for output	The A/D converter is in single scan mode (not the double trigger mode) or continuous scan mode.
Parameter	None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output	R_PG_ADC_12_S12AD0.c
RPDL function	R_ADC_12_Control

Details
- Starts A/D conversion by an A/D converter for which the software trigger has been selected as the activation source.

Example

The following setting has been made through the GUI.
- Select the software trigger as the activation source.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set();              // The clock-generation circuit has to be set first.
    R_PG_ADC_12_Set_S12AD0();      // Set up the 12-bit A/D converter (S12AD0).

    // A software trigger starts A/D conversion.
    R_PG_ADC_12_StartConversionSW_S12AD0();
}
```

5.22.3 R_PG_ADC_12_StopConversion_S12AD0

Definition bool R_PG_ADC_12_StopConversion_S12AD0(void)

Description Stops A/D conversion

Parameter None

Return value

true	Stopping conversion succeeded.
false	Stopping conversion failed.

File for output R_PG_ADC_12_S12AD0.c

RPDL function R_ADC_12_Control

Details

- Stops A/D conversion in the continuous scan mode. In other modes, this function need not be called after A/D conversion has ended.
- After this function has stopped A/D conversion, continuous scanning is resumed on input of the A/D-conversion start trigger. To end continuous scanning, stop the A/D conversion unit by calling R_PG_ADC_12_StopModule_S12AD0.

Example The following setting has been made through the GUI.

- Select the continuous scan mode as the operating mode.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set();              // The clock-generation circuit has to be set first.
    R_PG_ADC_12_Set_S12AD0();      // Set up the 12-bit A/D converter (S12AD0).
}

void func2(void)
{
    // Stop continuous scanning.
    R_PG_ADC_12_StopConversion_S12AD0();
}
```

5.22.4 R_PG_ADC_12_GetResult_S12AD0

Definition bool R_PG_ADC_12_GetResult_S12AD0(uint16_t * result)

Description Gets the result of A/D conversion of an analog input or internal reference voltage

Parameter

uint16_t * result	Destination for storage of the result of A/D conversion

Return value

true	Acquisition of the result succeeded.
false	Acquisition of the result failed.

File for output R_PG_ADC_12_S12AD0.c

RPDL function R_ADC_12_Read

Details

- At least two 16-byte spaces are needed for storage of the acquired result.
- When A/D conversion is in progress at the time of calling this function and a name for the interrupt notification function has not been specified through the GUI, the function waits until the end of A/D conversion before reading the result.

Example The following settings have been made through the GUI.

- Select the group scan mode.
  Trigger for group A: TRG4AN
  Trigger for group B: TRG4BN
- Select the following analog input pins.
  Group A: AN000 and AN015
  Group B: AN003 and AN006
- Specify S12ad0AIntFunc as the A/D-conversion end interrupt notification function for group A.
  Specify S12ad0BIntFunc as the A/D-conversion end interrupt notification function for group B.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
      R_PG_Clock_Set();                // The clock-generation circuit has to be set first.
      R_PG_ADC_12_Set_S12AD0();       // Set up the 12-bit A/D converter (S12AD0).
}

// A/D-conversion end interrupt notification function for group A
void S12ad0AIntFunc(void)
{
      uint16_t result[16];       // Destination for storing the result of A/D conversion on
                                 //AN000 and AN015
      uint16_t result_an000;     // Destination for storing the result of A/D conversion on
                                 //AN000
      uint16_t result_an015;     // Destination for storing the result of A/D conversion on
                                 //AN015

      // Acquire the results of A/D conversion for group A.
      R_PG_ADC_12_GetResult_S12AD0( result );

      result_an000 = result[0];
      result_an015 = result[15];
}
```

```
// A/D-conversion end interrupt notification function for group B
void S12ad0BIntFunc(void)
{
    uint16_t result[16];      // Destination for storing the result of A/D conversion on
                              //AN003 and AN006
    uint16_t result_an003;    // Destination for storing the result of A/D conversion on
                              //AN003
    uint16_t result_an006;    // Destination for storing the result of A/D conversion on
                              //AN006

    // Acquire the results of A/D conversion for group B.
    R_PG_ADC_12_GetResult_S12AD0( result );

    result_an003 = result[3];
    result_an006 = result[6];
}
```

5.22.5 R_PG_ADC_12_GetResult_DblTrigger_S12AD0

Definition: bool R_PG_ADC_12_GetResult_DblTrigger_S12AD0(uint16_t * result)

Description: Gets the result of A/D conversion in response to the second trigger in the double-trigger mode

Conditions for output: The A/D converter is in the double-trigger mode.

Definition

uint16_t * result	Destination for storage of the result of A/D conversion

Return value

true	Acquisition of the result succeeded.
false	Acquisition of the result failed.

File for output: R_PG_ADC_12_S12AD0.c

RPDL function: R_ADC_12_Read

Details

- Acquires the result of A/D conversion in response to the second trigger in the double-trigger mode.
- Data on one channel are acquired.
  When A/D conversion is in progress at the time of calling this function and a name for the interrupt notification function has not been specified through the GUI, the function waits until the end of A/D conversion before reading the result.

Example

The following settings have been made through the GUI.

- Select the double trigger mode (trigger: TRG4ABN).
- Select AN003 as an analog input pin.
- Specify S12ad0AIntFunc as the A/D-conversion end interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set();              // The clock-generation circuit has to be set first.
    R_PG_ADC_12_Set_S12AD0();   // Set up the 12-bit A/D converter (S12AD0).
}

// A/D-conversion end interrupt notification function
void S12ad0AIntFunc(void)
{
    uint16_t result[16];        // Destination for storing result 1 of A/D conversion on AN003
    uint16_t result_an003_2;   // Destination for storing result 2 of A/D conversion on
                                //AN003

    // Acquire result 1 of A/D conversion.
    R_PG_ADC_12_GetResult_S12AD0( result );

    // Acquire result 2 of A/D conversion.
    R_PG_ADC_12_GetResult_DblTrigger_S12AD0( &result_an003_2 );
}
```

5.22.6 R_PG_ADC_12_GetResult_SelfDiag_S12AD0

Definition bool R_PG_ADC_12_GetResult_SelfDiag_S12AD0(uint16_t * result)

Description Gets the result of A/D conversion as part of self diagnosis by the A/D converter

Parameter

uint16_t * result	Destination for storage of the result of A/D conversion

Return value

true	Acquisition of the result succeeded.
false	Acquisition of the result failed.

File for output R_PG_ADC_12_S12AD0.c

RPDL function R_ADC_12_Read

Details

- Acquires the result of A/D conversion performed as part of self diagnosis.
- When you use the self-diagnosis facility, self diagnosis takes place once at the beginning of each round of scanning with A/D conversion of one of the three voltages generated within the A/D converter.
- The acquired result of A/D conversion includes self-diagnosis status information*, which is in either of the following formats.

  When the data placement selected through the GUI is right-alignment
  b15-b14: Self-diagnosis status information*
  b11-b0: Result of A/D conversion as part of self diagnosis
  When the data placement selected through the GUI is left-alignment
  b15-b4: Result of A/D conversion as part of self diagnosis
  b1-b0: Self-diagnosis status information*

  Note: The self-diagnosis status information has the following meanings.
  b'00: Self diagnosis has not been performed.
  b'01: Self diagnosis on 0[V] voltage has been performed.
  b'10: Self diagnosis on VREFH0 × 1/2 voltage has been performed.
  b'11: Self diagnosis on VREFH0 voltage has been performed.

Example The following settings have been made through the GUI.

- Select the single scan mode.
- Select AN000 and AN008 as analog input pins.
- Select the software trigger as the activation source.
- Select right-alignment for data placement.
- Enable the self-diagnosis facility.
- Specify S12ad0AIntFunc as the A/D-conversion end interrupt notification function.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint16_t result_selfdiag;   // Destination for storing the result of A/D conversion as part of
                            // self diagnosis
uint16_t adrd_ad;           // Destination for storing the result of 12-bit A/D conversion
uint16_t adrd_diagst;       // Destination for storing the self-diagnosis status information
uint16_t result[16];        // Destination for storing the result of A/D conversion on AN000
                            // and AN008
uint16_t result_an000;      // Destination for storing the result of A/D conversion on AN000
```

```
uint16_t result_an008;    // Destination for storing the result of A/D conversion on AN008

void func(void)
{
    R_PG_Clock_Set();                // The clock-generation circuit has to be set first.
    R_PG_ADC_12_Set_S12AD0();   // Set up the 12-bit A/D converter (S12AD0).

    // A software trigger starts A/D conversion.
    R_PG_ADC_12_StartConversionSW_S12AD0();
}

// A/D-conversion end interrupt notification function
void S12ad0AIntFunc(void)
{
    // Acquire the results of A/D conversion as part of self diagnosis.
    R_PG_ADC_12_GetResult_SelfDiag_S12AD0( &result_selfdiag );

    adrd_ad = (result_selfdiag & 0x0fff);
    adrd_diagst = (result_selfdiag >> 14);

    // Acquire the result of A/D conversion on AN000 and AN008.
    R_PG_ADC_12_GetResult_S12AD0( result );

    result_an000 = result[0];
    result_an008 = result[8];
}
```

5.22.7 R_PG_ADC_12_StopModule_S12AD0

Definition bool R_PG_ADC_12_StopModule_S12AD0(void)

Description Shuts down the 12-bit A/D converter

Parameter None

Return value

true	Shutting down succeeded.
false	Shutting down failed.

File for output R_PG_ADC_12_S12AD0.c

RPDL function R_ADC_12_Destroy

Details

- Stops the 12-bit A/D converter and places it in the module-stop state.

Example

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint16_t result[16];    // Destination for storage of the result of A/D conversion

void func1(void)
{
    R_PG_Clock_Set();              // The clock-generation circuit has to be set first.
    R_PG_ADC_12_Set_S12AD0();      // Set up the 12-bit A/D converter (S12AD0).
}

void func2(void)
{
    // Stop continuous scanning.
    R_PG_ADC_12_StopConversion_S12AD0();

    // Acquire the result of A/D conversion.
    R_PG_ADC_12_GetResult_S12AD0( result );

    // Stop the 12-bit A/D converter (S12AD0).
    R_PG_ADC_12_StopModule_S12AD0();
}
```

5.23 Comparator A (CMPA)

5.23.1 R_PG_CPA_Set_CP*<comparator circuit number>*

Definition: bool R_PG_CPA_Set_CP<*comparator circuit number*> (void)
<*comparator circuit number*>: A1 or A2

Description: Sets up comparator n n: A1 or A2

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_CP<*comparator circuit number*>.c <*comparator circuit number*>: A1 or A2

RPDL function: R_CPA_Create

Details:
- This function carries out initial setting of a comparator n. n: A1 or A2
- Before calling this function, call R_PG_Clock_Set to set the clock-generation circuit.

Example:

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func(void)
{
    R_PG_Clock_Set();   // The clock-generation circuit has to be set first.

    // Sets up comparator A1.
    R_PG_CPA_Set_CPA1();
}
```

5.23.2 R_PG_CPA_Disable_CP<*comparator circuit number*>

Definition: bool R_PG_CPA_Disable_CP<*comparator circuit number*> (void)
<*comparator circuit number*>: A1 or A2

Description: Disable comparator n circuit n: A1 or A2

Parameter: None

Return value:

true	Setting was made correctly.
false	Setting failed.

File for output: R_PG_CP<*comparator circuit number*>.c <*comparator circuit number*>: A1 or A2

RPDL function: R_CPA_Control

Details:
- This function disables comparator n circuit. n: A1 or A2

Example:

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

void func1(void)
{
    R_PG_Clock_Set();   // The clock-generation circuit has to be set first.

    // Sets up comparator A1.
    R_PG_CPA_Set_CPA1();
}

void func2(void)
{
    // Disable comparator A1 circuit.
    R_PG_CPA_Disable_CPA1();
}
```

5.23.3 R_PG_CPA_GetStatus

Definition bool R_PG_CPA_GetStatus
(bool * cpa1_detect, bool * cpa1_monitor, bool * cpa2_detect, bool * cpa2_monitor)

Description Get comparator A status flag

Parameter

bool * cpa1_detect	The address of storage area for Comparator A1 Voltage Change Detection Flag
bool * cpa1_monitor	The address of storage area for Comparator A1 Signal Monitor Flag
bool * cpa2_detect	The address of storage area for Comparator A2 Voltage Change Detection Flag
bool * cpa2_monitor	The address of storage area for Comparator A2 Signal Monitor Flag

Return value

true	Acquisition succeeded.
false	Acquisition failed.

File for output R_PG_CPA.c

RPDL function R_CPA_GetStatus

Details
- This function acquires the status flag of Comparator A.
- Specify 0 for a flag that is not required.

Example The following settings have been made through the GUI.
- Use comparator A1.
- [The comparator An interrupt is generated when CMPAn has crossed the CVREFA] is selected as Comparator An mode.
- [Maskable interrupt] is selected as Comparator An interrupt type.

```
// Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

bool cpa1_mon;

void func(void)
{
    R_PG_Clock_Set();   // The clock-generation circuit has to be set first.

    // Sets up comparator A1.
    R_PG_CPA_Set_CPA1();
}

void CMPA1IntFunc(void)
{
    // Get comparator A status flag.
    R_PG_CPA_GetStatus(0, &cpa1_mon, 0, 0);
}
```

5.24 Data Operation Circuit (DOC)

5.24.1 R_PG_DOC_Set

Definition bool R_PG_DOC_Set (void)

Description Set up the Data Operation Circuit

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Create

Details
- Releases the DOC from the module-stop and makes initial settings.
- In Addition Mode an interrupt is generated if the result of the addition exceeds FFFFh.
- In Subtraction Mode an interrupt is generated if the result of the subtraction is less than zero.
- In Comparison Mode an interrupt is generated when the comparison criteria (Match or Mismatch) is met.
- After calling the interrupt notification function the DOC flag is automatically cleared.

Example A case where the setting is made as follows.
- [Data comparison mode] is selected for the operating mode
- [Detects match as a result of data comparison] is selected for the detection condition
- Comparison reference is 1
- DopcfIntFunc was specified as the interrupt notification function name

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint16_t input_data[10]={1,0,0,1,0,0,0,0,0,1};
uint16_t comp_match_cnt=0;

void func(void)
{
	R_PG_DOC_Set();	//Set up the data operation circuit
	R_PG_DOC_InputData(input_data, 10);	//Input data
}

//Data Operation Circuit interrupt notification function
void DopcfIntFunc(void)
{
	comp_match_cnt++;
}
```

5.24.2 R_PG_DOC_GetStatusFlag

Definition bool R_PG_DOC_GetStatusFlag (bool * status)

Description Acquire the status of the data operation circuit

Parameter

bool * status	The address of the storage area for the status flag

Return value

true	Acquisition of the flag succeeded.
false	Acquisition of the flag failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Read

Details

- Acquires the status flag (the result of an operation) of the data operation circuit.
- The status flag is set to 1 as follows:
  - In Comparison Mode when the comparison criteria (Match / Mismatch) is met.
  - In Addition Mode if the result of the addition exceeds FFFFh.
  - In Subtraction Mode if the result of the subtraction is less than zero.
- If the DOC flag is set the flag is cleared after calling this function.

Example Refer to the example of R_PG_DOC_StopModule

5.24.3 R_PG_DOC_GetResult

Definition bool R_PG_DOC_GetResult (uint16_t * result)

Description Acquire the result of data operation

Parameter

uint16_t * result	The address of the storage area for the operation result

Return value

true	Acquisition of the result succeeded.
false	Acquisition of the result failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Read

Details
- Acquires the value of DODSR (DOC Data Setting Register).
- The content of the acquired value of each operating mode is different as follows:
  Data comparison mode :Comparison reference
  Data addition mode :The result of data addition
  Data subtraction mode :The result of data subtraction

Example Refer to the example of R_PG_DOC_StopModule

5.24.4 R_PG_DOC_InputData

Definition bool R_PG_DOC_InputData (uint16_t * data, uint16_t count)

Description Input data

Parameter

uint16_t * data	The address of the storage area for the input data
uint16_t count	The number of the input data

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Write

Details

- Data for the operation is set to DODIR (DOC Data Input Register).

  Data comparison mode :The compared data is set

  Data addition mode :The added data is set

  Data subtraction mode :The subtracted data is set

Example Refer to the example of R_PG_DOC_Set

5.24.5 R_PG_DOC_UpdateData

Definition bool R_PG_DOC_UpdateData (uint16_t data)

Description Update data

Parameter

uint16_t data	Data for update

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Control

Details

- The value of DODSR (DOC Data Setting Register) is updated to the specified data.

  Data comparison mode :Comparison reference is updated
  Data addition mode :Initial value of addition result is updated
  Data subtraction mode :Initial value of subtraction result is updated

Example A case where the setting is made as follows.

- [Data comparison mode] is selected for the operating mode
- [Detects match as a result of data comparison] is selected for the detection condition
- Comparison reference is 0
- DopcfIntFunc was specified as the interrupt notification function name

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint16_t input_data[10]={1,0,0,1,0,0,0,0,0,1};
uint16_t comp_match_cnt=0;
uint16_t comp_match_0, comp_match_1;

void func(void)
{
	R_PG_DOC_Set();   //Set up the data operation circuit
	R_PG_DOC_InputData(input_data, 10);   //Input data

	comp_match_0 = comp_match_cnt;

	R_PG_DOC_UpdateData(1);   //Update data
	R_PG_DOC_InputData(input_data, 10);   //Input data

	comp_match_1 = comp_match_cnt - comp_match_0;
}

//Data Operation Circuit interrupt notification function
void DopcfIntFunc(void)
{
	comp_match_cnt++;
}
```

5.24.6 R_PG_DOC_StopModule

Definition bool R_PG_DOC_StopModule (void)

Description Disable the data operation circuit

Parameter None

Return value

true	Setting was made correctly.
false	Setting failed.

File for output R_PG_DOC.c

RPDL function R_DOC_Destroy

Details
- Enable the DOC module stop state.

Example
A case where the setting is made as follows.
- [Data addition mode] is selected for the operating mode
- Initial value of addition or subtraction result is 0

```
//Include "R_PG_<project name>.h" to use this function.
#include "R_PG_default.h"

uint16_t result;
uint16_t data=0x0000;

void func(void)
{
	bool status;

	//Set up the data operation circuit
	R_PG_DOC_Set();

	while(1){
		//Input data
		R_PG_DOC_InputData(&data, 1);

		//Acquire the status of the data operation circuit
		R_PG_DOC_GetStatusFlag(&status);

		if(status == true){
				break;
		}

		//Acquire the result of data operation
		R_PG_DOC_GetResult(&result);

		data++;
	}

	//Disable the data operation circuit
	R_PG_DOC_StopModule();
}
```

5.25 Notes on Notification Functions

5.25.1 Interrupts and processor mode

The RX CPU has two processor modes; supervisor and user.The driver functions will be executed by the CPU in user mode.However any notification functions which are called by the interrupt handlers in Renesas Peripheral Driver Library will be executed by the CPU in supervisor mode.This means that the privileged CPU instructions (RTFI, RTE and WAIT) can be executed by the notification function and any function that is called by the notification function.
The user must:

1. Avoid using the RTFI and RTE instructions.
   These instructions are issued by the API interrupt handlers, so there should be no need for the user's code to use these instructions.
2. Use the wait() intrinsic function with caution.
   This instruction is used by some API functions as part of power management, so there should be no need for the user's code to use this instruction.

More information on the processor modes can be found in §1.4 of the RX Family software manual.

5.25.2 Interrupts and DSP instructions

The accumulator (ACC) register is modified by the following instructions:

• DSP (MACHI, MACLO, MULHI, MULLO, MVTACHI, MVTACLO and RACW).
• Multiply and multiply-and-accumulate (EMUL, EMULU, FMUL, MUL, and RMPA)

The accumulator (ACC) register is not pushed onto the stack by the interrupt handlers in Renesas Peripheral Driver Library.
If DSP instructions are being utilised in the users' code, notification functions which are called by the interrupt handlers in Renesas Peripheral Driver Library should either

1. Avoid using instructions which modify the ACC register.
2. Take a copy of the ACC register and restore it before exiting the callback function.

6. Registering Files with the IDE and Building Them

Note the following points when registering the files generated by the Peripheral Driver Generator with the IDE(High-performance Embedded Workshop, CubeSuite+ or e2 studio) and building them.

(1) Source files generated by the Peripheral Driver Generator do not include a startup program. For this reason, you need to create a startup program by specifying [Application] as the project type during the process of creating a IDE project.

(2) Source files registered by the Peripheral Driver Generator with the IDE include an interrupt handler and vector table. Since the interrupt handler and vector table must not overlap with those included in the startup program created by using the IDE, intprg.c and vecttbl.c are excluded from the set of files that are included in the build.

(3) Source files Interrupt_xxx.c, which includes the interrupt handler that the Peripheral Driver Generator registers with the IDE, is overwritten when the Peripheral Driver GeneratorG generates source files.

(4) The Renesas Peripheral Driver Library is produced using the default compiler options (except that [Double precision] is selected for [Precision of double]). If you specify the compiler options other than the defaults in your project, you have to utilize Renesas Peripheral Driver Library source under your responsibility.

(5) The Renesas Peripheral Driver Library has been built specifying double-precision floating point. Therefore, to build the user program with Peripheral Driver Generator-generated files, specify double-precision floating point option in builder settings of IDE as follows. It’s unnecessary at the time of e2 studio use.

CubeSuite+

1. Open the [CC-RX Property] by double-clicking [CC-RX(Build Tool)] in project tree.
2. In the [CPU] category, select [Handles in double precision] for [Precision of the double type and long double type].

High-performance Embedded Workshop

1. Select [Build]->[RX Standard Toolchain] from main menu to open the [RX Standard Toolchain] dialog box.
2. Select the [CPU] tab.
3. Click the [Details] button to open the [CPU details] dialog box.
4. Select [Double precision] for [Precision of double].

(6) The Renesas Peripheral Driver Library use FIXEDVECT section that address is 0xFFFFFFD0. Therefore, to build the user program with Peripheral Driver Generator-generated files, specify the linker option in builder setting of IDE as follows. It’s necessary at the time of e2 studio use.

1. Select the project on Project Explorer.
2. Select [File]->[Properties] from main menu to open the [Properties] window.
3. Select [C/C++ build] ->[Settings]
4. Select [All configurations] for [Configuration]
5. Select [Linker] -> [Section] to show [Section viewer]
6. Set the address of the FIXEDVECT section as 0xFFFFFFD0.

Appendix 1. Pin Functions for which the Allocation Can be Changed

Table a-1.1 100-pin LQFP (the Upper Row of Each Pair is the Default Selection)

Peripheral module	Pin function	Selection of assignment	Pin No.
CAC	CACREF	PA0/MTIOC4A/SSLA1/CACREF	70
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	45
		PH0/CACREF	38
ICUb (External Interrupts)	IRQ0	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	20
		PD0/IRQ0	86
		PH1/TMO0/IRQ0	37
	IRQ1	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	19
		PD1/MTIOC4B/IRQ1	85
		PH2/TMRI0/IRQ1	36
	IRQ2	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	18
		P12/TMCI1/SCL/IRQ2	34
		PD2/MTIOC4D/IRQ2	84
	IRQ3	P33/MTIOC0D/TMRI3/POE3#/RXD6/SMISO6/SSCL6/IRQ3	17
		P13/MTIOC0B/TMO3/SDA/IRQ3	33
		PD3/POE8#/IRQ3	83
	IRQ4	PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	59
		P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	32
		P34/MTIOC0A/TMCI3/POE2#/SCK6/IRQ4	16
		PD4/POE3#/IRQ4	82
	IRQ5	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
		P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	31
		PD5/MTIC5W/POE2#/IRQ5	81
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	73
	IRQ6	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	67
		P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		PD6/MTIC5V/POE1#/IRQ6	80
		PE6/IRQ6/AN014	72
	IRQ7	PE2/MTIOC4A/RXD12/RXDX12/SMISO12/SSCL12/IRQ7/AN010	76
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		PD7/MTIC5U/POE0#/IRQ7	79
		PE7/IRQ7/AN015	71
MTU0-5	MTCLKA	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	32
		P24/MTIOC4A/MTCLKA/TMRI1	24
		PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	46
	MTCLKB	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	31
		P25/MTIOC4C/MTCLKB/ADTRG0#	23
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	45
	MTCLKC	P22/MTIOC3B/MTCLKC/TMO0	26
		PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	39
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
	MTCLKD	P23/MTIOC3D/MTCLKD	25
		PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	67
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	47

MTU0	MTIOC0A	P34/MTIOC0A/TMCI3/POE2#/SCK6/IRQ4	16
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	57
	MTIOC0B	P13/MTIOC0B/TMO3/SDA/IRQ3	33
		P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	31
		PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	69
	MTIOC0C	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	18
		PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	59
	MTIOC0D	P33/MTIOC0D/TMRI3/POE3#/RXD6/SMISO6/SSCL6/IRQ3	17
		PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	67
MTU1	MTIOC1A	P20/MTIOC1A/TMRI0	28
		PE4/MTIOC4D/MTIOC1A/AN012/CMPA2	74
	MTIOC1B	P21/MTIOC1B/TMCI0	27
		PB5/MTIOC2A/MTIOC1B/TMRI1/POE1#/SCK9	55
MTU2	MTIOC2A	P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	22
		PB5/MTIOC2A/MTIOC1B/TMRI1/POE1#/SCK9	55
	MTIOC2B	P27/MTIOC2B/TMCI3/SCK1	21
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	73
MTU3	MTIOC3A	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	32
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		PC1/MTIOC3A/SCK5/SSLA2	51
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	45
		PJ1/MTIOC3A	6
	MTIOC3B	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		P22/MTIOC3B/MTCLKC/TMO0	26
		PB7/MTIOC3B/TXD9/SMOSI9/SSDA9	53
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	47
	MTIOC3C	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		PC0/MTIOC3C/CTS5#/RTS5#/SS5#/SSLA1	52
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	46
		PJ3/MTIOC3C/CTS6#/RTS6#/SS6#	4
	MTIOC3D	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		P23/MTIOC3D/MTCLKD	25
		PB6/MTIOC3D/RXD9/SMISO9/SSCL9	54
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
MTU4	MTIOC4A	P24/MTIOC4A/MTCLKA/TMRI1	24
		PA0/MTIOC4A/SSLA1/CACREF	70
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	57
		PE2/MTIOC4A/RXD12/RXDX12/SMISO12/SSCL12/IRQ7/AN010	76
	MTIOC4B	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	20
		P54/MTIOC4B/TMCI1	40
		PC2/MTIOC4B/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	50
		PD1/MTIOC4B/IRQ1	85
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/SS12#/AN011/CMPA1	75
	MTIOC4C	P25/MTIOC4C/MTCLKB/ADTRG0#	23
		PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	59
		PE1/MTIOC4C/TXD12/TXDX12/SIOX12/SMOSI12/SSDA12/AN009	77
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	73
	MTIOC4D	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	19
		P55/MTIOC4D/TMO3	39
		PC3/MTIOC4D/TXD5/SMOSI5/SSDA5/IRTXD5	49
		PD2/MTIOC4D/IRQ2	84

		PE4/MTIOC4D/MTIOC1A/AN012/CMPA2	74
MTU5	MTIC5U	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
		PD7/MTIC5U/POE0#/IRQ7	79
	MTIC5V	PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
		PD6/MTIC5V/POE1#/IRQ6	80
	MTIC5W	PB0/MTIC5W/RXD6/SMISO6/SSCL6/RSPCKA	61
		PD5/MTIC5W/POE2#/IRQ5	81
POE	POE0#	PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
		PD7/MTIC5U/POE0#/IRQ7	79
	POE1#	PB5/MTIOC2A/MTIOC1B/TMRI1/POE1#/SCK9	55
		PD6/MTIC5V/POE1#/IRQ6	80
	POE2#	P34/MTIOC0A/TMCI3/POE2#/SCK6/IRQ4	16
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
		PD5/MTIC5W/POE2#/IRQ5	81
	POE3#	P33/MTIOC0D/TMRI3/POE3#/RXD6/SMISO6/SSCL6/IRQ3	17
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	57
		PD4/POE3#/IRQ4	82
	POE8#	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	20
		PD3/POE8#/IRQ3	83
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/SS12#/AN011/CMPA1	75
TMR0	TMCI0	P21/MTIOC1B/TMCI0	27
		PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	59
		PH3/TMCI0	35
	TMRI0	P20/MTIOC1A/TMRI0	28
		PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
		PH2/TMRI0/IRQ1	36
	TMO0	P22/MTIOC3B/MTCLKC/TMO0	26
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	57
		PH1/TMO0/IRQ0	37
TMR1	TMCI1	P12/TMCI1/SCL/IRQ2	34
		P54/MTIOC4B/TMCI1	40
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
	TMRI1	P24/MTIOC4A/MTCLKA/TMRI1	24
		PB5/MTIOC2A/MTIOC1B/TMRI1/POE1#/SCK9	55
	TMO1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	22
TMR2	TMCI2	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	31
		P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	19
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	46
	TMRI2	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	32
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	47
	TMO2	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	45
TMR3	TMCI3	P27/MTIOC2B/TMCI3/SCK1	21
		P34/MTIOC0A/TMCI3/POE2#/SCK6/IRQ4	16
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
	TMRI3	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	20
		P33/MTIOC0D/TMRI3/POE3#/RXD6/SMISO6/SSCL6/IRQ3	17
	TMO3	P13/MTIOC0B/TMO3/SDA/IRQ3	33

		P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	18
		P55/MTIOC4D/TMO3	39
RTCc	RTCOUT	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	18
SCI1	RXD1	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	31
	SMISO1	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	20
	SSCL1		
	TXD1	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
	SMOSI1	P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	22
	SSDA1		
	SCK1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		P27/MTIOC2B/TMCI3/SCK1	21
	CTS1#	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	32
	RTS1#	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	19
	SS1#		
SCI5	RXD5	PA2/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	68
	SMISO5	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	67
	SSCL5	PC2/MTIOC4B/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	50
	IRRXD5		
	TXD5	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
	SMOSI5	PC3/MTIOC4D/TXD5/SMOSI5/SSDA5/IRTXD5	49
	SSDA5		
	IRTXD5		
	SCK5	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	69
		PC1/MTIOC3A/SCK5/SSLA2	51
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
	CTS5#	PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
	RTS5#	PC0/MTIOC3C/CTS5#/RTS5#/SS5#/SSLA1	52
	SS5#		
SCI6	RXD6	P33/MTIOC0D/TMRI3/POE3#/RXD6/SMISO6/SSCL6/IRQ3	17
	SMISO6	PB0/MTIC5W/RXD6/SMISO6/SSCL6/RSPCKA	61
	SSCL6		
	TXD6	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	18
	SMOSI6	PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	59
	SSDA6		
	SCK6	P34/MTIOC0A/TMCI3/POE2#/SCK6/IRQ4	16
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	57
	CTS6#	PB2/CTS6#/RTS6#/SS6#	58
	RTS6#	PJ3/MTIOC3C/CTS6#/RTS6#/SS6#	4
	SS6#		
RIIC0	SCL	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		P12/TMCI1/SCL/IRQ2	34
	SDA	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		P13/MTIOC0B/TMO3/SDA/IRQ3	33
RSPI0	RSPCKA	PA5/RSPCKA	65
		PB0/MTIC5W/RXD6/SMISO6/SSCL6/RSPCKA	61
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	47
	MOSIA	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30

		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	64
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	46
	MISOA	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	29
		PA7/MISOA	63
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	45
	SSLA0	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	66
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	48
	SSLA1	PA0/MTIOC4A/SSLA1/CACREF	70
		PC0/MTIOC3C/CTS5#/RTS5#/SS5#/SSLA1	52
	SSLA2	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	69
		PC1/MTIOC3A/SCK5/SSLA2	51
	SSLA3	PA2/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	68
		PC2/MTIOC4B/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	50
S12AD	ADTRG0#	P07/ADTRG0#	98
		P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	30
		P25/MTIOC4C/MTCLKB/ADTRG0#	23

Table a-1.2 64-pin LQFP (the Upper Row of Each Pair is the Default Selection)

Peripheral module	Pin function	Selection of assignment	Pin No.
CAC	CACREF	PA0/MTIOC4A/SSLA1/CACREF	45
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	27
		PH0/CACREF	24
ICUb (External Interrupts)	IRQ0	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	14
		PH1/TMO0/IRQ0	23
	IRQ1	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	13
		PH2/TMRI0/IRQ1	22
	IRQ4	PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	37
		P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	20
	IRQ5	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	42
		P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	19
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	46
	IRQ6	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	43
		P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
	IRQ7	PE2/MTIOC4A/RXD12/RXDX12/SMISO12/SSCL12/IRQ7/AN010	49
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
MTU0-5	MTCLKA	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	20
		PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	42
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	28
	MTCLKB	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	19
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	41
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	27
	MTCLKC	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	44
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	30
	MTCLKD	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	43
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	29
MTU0	MTIOC0A	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	19
		PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	44

	MTIOC0B	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	12
		PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	37
MTU1	MTIOC1A	P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	16
		PB5/MTIOC2A/MTIOC1B/TMRI1/POE1#/SCK9	35
	MTIOC1B	P27/MTIOC2B/TMCI3/SCK1	15
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	46
MTU3	MTIOC3A	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	20
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	27
	MTIOC3B	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		PB7/PC1/MTIOC3B/TXD9/SMOSI9/SSDA9	33
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	29
	MTIOC3C	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	28
	MTIOC3D	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		PB6/PC0/MTIOC3D/RXD9/SMISO9/SSCL9	34
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	30
MTU4	MTIOC4A	PA0/MTIOC4A/SSLA1/CACREF	45
		PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	36
		PE2/MTIOC4A/RXD12/RXDX12/SMISO12/SSCL12/IRQ7/AN010	49
	MTIOC4B	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	14
		P54/MTIOC4B/TMCI1	26
		PC2/MTIOC4B/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	32
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/SS12#/AN011/CMPA1	48
	MTIOC4C	PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	37
		PE1/MTIOC4C/TXD12/TXDX12/SIOX12/SMOSI12/SSDA12/AN009	50
		PE5/MTIOC4C/MTIOC2B/IRQ5/AN013	46
	MTIOC4D	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	13
		P55/MTIOC4D/TMO3	25
		PC3/MTIOC4D/TXD5/SMOSI5/SSDA5/IRTXD5	31
		PE4/MTIOC4D/MTIOC1A/AN012/CMPA2	47
POE	POE8#	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	14
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/SS12#/AN011/CMPA1	48
TMR0	TMCI0	PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	37
		PH3/TMCI0	21
	TMRI0	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	42
		PH2/TMRI0/IRQ1	22
	TMO0	PB3/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	36
		PH1/TMO0/IRQ0	23
TMR1	TMCI1	P54/MTIOC4B/TMCI1	26
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	30
	TMO1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	16

TMR2	TMCI2	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	19
		P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	13
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	28
	TMRI2	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	20
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	29
	TMO2	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	27
TMR3	TMCI3	P27/MTIOC2B/TMCI3/SCK1	15
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	41
	TMO3	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	12
		P55/MTIOC4D/TMO3	25
RTCc	RTCOUT	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	12
SCI1	RXD1 SMISO1 SSCL1	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	19
		P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	14
	TXD1 SMOSI1 SSDA1	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	16
	SCK1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		P27/MTIOC2B/TMCI3/SCK1	15
	CTS1# RTS1# SS1#	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	20
		P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	13
SCI5	RXD5 SMISO5 SSCL5	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	43
		PC2/MTIOC4B/RXD5/SMISO5/SSCL5/IRRXD5/SSLA3	32
	TXD5 SMOSI5 SSDA5	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	42
		PC3/MTIOC4D/TXD5/SMOSI5/SSDA5/IRTXD5	31
	SCK5	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	44
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	30
SCI6	TXD6 SMOSI6 SSDA6	P32/MTIOC0C/TMO3/TXD6/SMOSI6/SSDA6/IRQ2/RTCOUT	12
		PB1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	37
RSPI0	RSPCKA	PB0/MTIC5W/RXD6/SMISO6/SSCL6/RSPCKA	39
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	29

	MOSIA	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/RTCOUT/ADTRG0#	18
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	41
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	28
	MISOA	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	17
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	27
	SSLA0	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	42
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	30

Table a-1.3 48-pin LQFP (the Upper Row of Each Pair is the Default Selection)

Peripheral module	Pin function	Selection of assignment	Pin No.
CAC	CACREF	PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	21
		PH0/CACREF	20
ICUb (External Interrupts)	IRQ0	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	10
		PH1/TMO0/IRQ0	19
	IRQ1	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	9
		PH2/TMRI0/IRQ1	18
	IRQ4	PB1/PC1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	27
		P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	16
	IRQ5	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	32
		P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	15
	IRQ6	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	33
		P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
	IRQ7	PE2/MTIOC4A/RXD12/RXDX12/SSCL12/IRQ7/AN010	37
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
MTU0-5	MTCLKA	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	16
		PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	32
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	22
	MTCLKB	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	15
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	31
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	21
	MTCLKC	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	34
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	24
	MTCLKD	PA3/MTIOC0D/MTCLKD/RXD5/SMISO5/SSCL5/IRRXD5/IRQ6	33
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	23
MTU0	MTIOC0B	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	15
		PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	34
MTU2	MTIOC2A	P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	12
		PB5/PC3/MTIOC2A/MTIOC1B/TMRI1/POE1#	25

MTU3	MTIOC3A	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	16
		P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	21
	MTIOC3B	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	23
	MTIOC3C	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	22
	MTIOC3D	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	24
MTU4	MTIOC4A	PB3/PC2/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	26
		PE2/MTIOC4A/RXD12/RXDX12/SSCL12/IRQ7/AN010	37
	MTIOC4B	P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	30
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/AN011/CMPA1	36
	MTIOC4C	PB1/PC1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	27
		PE1/MTIOC4C/TXD12/TXDX12/SIOX12/SSDA12/AN009	38
	MTIOC4D	P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	9
		PE4/MTIOC4D/MTIOC1A/AN012/CMPA2	35
POE	POE8#	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	30
		PE3/MTIOC4B/POE8#/CTS12#/RTS12#/AN011/CMPA1	36
TMR0	TMCI0	PB1/PC1/MTIOC0C/MTIOC4C/TMCI0/TXD6/SMOSI6/SSDA6/IRQ4	27
		PH3/TMCI0	17
	TMRI0	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	32
		PH2/TMRI0/IRQ1	18
	TMO0	PB3/PC2/MTIOC0A/MTIOC4A/TMO0/POE3#/SCK6	26
		PH1/TMO0/IRQ0	19
TMR1	TMO1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	12
TMR2	TMCI2	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	15
		P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	9
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	22
	TMRI2	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	16
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	23
	TMO2	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	21
TMR3	TMCI3	P27/MTIOC2B/TMCI3/SCK1	11
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	31
SCI1	RXD1 SMISO1	P15/MTIOC0B/MTCLKB/TMCI2/RXD1/SMISO1/SSCL1/IRQ5	15
		P30/MTIOC4B/TMRI3/POE8#/RXD1/SMISO1/SSCL1/IRQ0	10

	SSCL1		
	TXD1 SMOSI1 SSDA1	P26/MTIOC2A/TMO1/TXD1/SMOSI1/SSDA1	12
		P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
	SCK1	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		P27/MTIOC2B/TMCI3/SCK1	11
	CTS1# RTS1# SS1#	P14/MTIOC3A/MTCLKA/TMRI2/CTS1#/RTS1#/SS1#/IRQ4	16
		P31/MTIOC4D/TMCI2/CTS1#/RTS1#/SS1#/IRQ1	9
SCI5	SCK5	PA1/MTIOC0B/MTCLKC/SCK5/SSLA2/CVREFA	34
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	24
RSPI0	RSPCKA	PB0/PC0/MTIC5W/RXD6/SMISO6/SSCL6/RSPCKA	29
		PC5/MTIOC3B/MTCLKD/TMRI2/RSPCKA	23
	MOSIA	P16/MTIOC3C/MTIOC3D/TMO2/TXD1/SMOSI1/SSDA1/MOSIA/SCL/IRQ6/ADTRG0#	14
		PA6/MTIC5V/MTCLKB/TMCI3/POE2#/CTS5#/RTS5#/SS5#/MOSIA	31
		PC6/MTIOC3C/MTCLKA/TMCI2/MOSIA	22
	MISOA	P17/MTIOC3A/MTIOC3B/TMO1/POE8#/SCK1/MISOA/SDA/IRQ7	13
		PC7/MTIOC3A/TMO2/MTCLKB/MISOA/CACREF	21
	SSLA0	PA4/MTIC5U/MTCLKA/TMRI0/TXD5/SMOSI5/SSDA5/IRTXD5/SSLA0/IRQ5	32
		PC4/MTIOC3D/MTCLKC/TMCI1/POE0#/SCK5/SSLA0	24

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Peripheral Driver Generator
Reference Manual

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