

RA Family, RX Family, RL78 Family, RE01 256KB or 1500KB Group

OB1203 Sample Software Manual

Introduction

This application note describes the sample software that is for use with the OB1203 sensor and runs on certain MCUs of the RA family, RX family, and RL78 family, and RE01 group MCUs with 256 KB or 1500 KB of flash memory.

The application note and the sample software are not medical devices.

Also, the algorithm for biometric data calculation used in this sample project has the constraint of sampling rate (Default: 10ms).

Please refer to the application note [R36AN0001EU] and OB1203 sensor page (OB1203 - Heart Rate, Blood Oxygen Concentration, Pulse Oximetry, Proximity, Light and Color Sensor | Renesas)

Target Devices

RA6M4 Group RX65N Group RL78/G14 Group RL78/G23 Group RE01 Group with 256 KB or 1500 KB of flash memory

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1. Overview

This sample software acquires data from the OB1203 sensor and handles calculation on the data. In combination with the I2C driver of the FSP, FIT, or code generator, the sample software controls the OB1203 through the I2C in the MCU to execute measurement, acquire ADC data, and calculate the acquired data.

2. Environment for Confirming Operation

2.1 Environment for Confirming Operation on an RA Family MCU

The operation of this software has been confirmed on an MCU of the RA family in the following environment.

Item	Description
Demonstration board	RTK7EKA6M4S00001BE (EK-RA6M4)
Microcontroller	RA6M4 (R7FA6M4AF3CFB: 144 pins)
Operating frequency	200 MHz
Operating voltage	5 V
Integrated development environment	e ² Studio 2023-01
C compiler	GCC 10.3.1.20210824
	IAR ANSI C/C++ Compiler V9.20.2.320/LNX for ARM BX
	ARM Compiler 6.17
FSP	V.3.7.0
RTOS	FreeRTOS [™] or Microsoft [®] Azure RTOS
Emulator	On-board debugger (J-LINK)
Interposer	Interposer board to convert Type2/3 to Type 6A PMOD standard (US082-INTERPEVZ)
Sensor board	Pulse oximetry, proximity, light, and color sensor Pmod™ board (US082- OB1203EVZ)

Table 2-1 Operating Environment for the RA Family MCU

Table 2-2 Amount of Memory Used in the RA Family MCU

Area	Size (Non-OS)	Size (Free RTOS)	Size (Azure RTOS)
ROM	14,054 bytes	14,755 bytes	14,691 bytes
RAM	5,564 bytes	5,922 bytes	6,049 bytes

Calculation of these sizes in memory only takes functions and variables related to the OB1203 sensor into account. They do not include the sizes of RTOS threads for the RTOS versions.

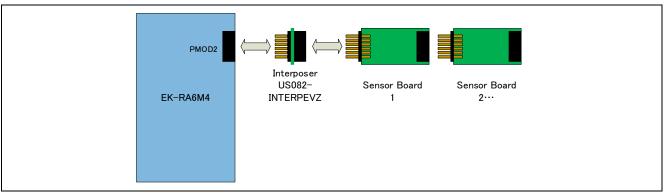


Figure 2-1 Hardware Connections for the RA Family



2.2 Environment for Confirming Operation on an RX Family MCU

The operation of this software has been confirmed on an MCU of the RX family in the following environment.

Item	Description
Demonstration board	RPBRX65N (Envision Kit RX65N)
Microcontroller	RX65N (R5F565NEDDFB: 144 pins)
Operating frequency	12 MHz
Operating voltage	5 V
Integrated development	e ² Studio 2023-01
environment	IAR EW for RX 4.20.1
C compiler	Renesas Electronics C/C++ compiler for RX family V.3.03.00
	GCC 8.3.0.202004
	IAR Toolchain for RX 8.4.10.7051
FIT	BSP V.7.20
RTOS	FreeRTOS™
Emulator	On-board debugger (E2OB)
Interposer	Interposer board to convert Type2/3 to Type 6A PMOD standard (US082-INTERPEVZ)
Sensor board	Pulse oximetry, proximity, light, and color sensor Pmod™ board (US082- OB1203EVZ)

Table 2-3 Operating Environment for the RX Family MCU

Table 2-4 Amount of Memory Used in the RX Family MCU

Area	Size (Non-OS)	Size (FreeRTOS)	Size (Azure RTOS)
ROM	12,343 bytes	12,839 bytes	12,874 bytes
RAM	6,204 bytes	6,312 bytes	6,680bytes

Calculation of these sizes in memory only takes functions and variables related to the OB1203 sensor into account. They do not include the sizes of RTOS threads for the RTOS versions.

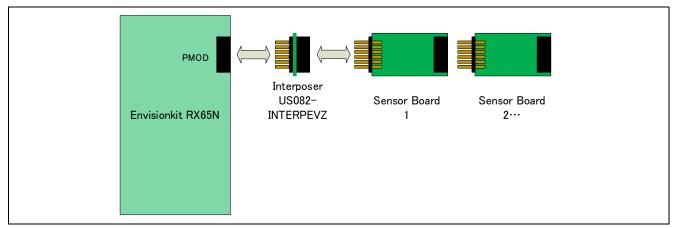


Figure 2-2 Hardware Connections for the RX Family



2.3 Environment for Confirming Operation on an RL78/G14 Group MCU

The operation of this software has been confirmed on an MCU of the RL78/G14 group in the following environment.

Item	Description
Demonstration board	RTK5RLG140C00000BJ (RL78/G14 Fast Prototyping Board)
Microcontroller	RL78/G14 (R5F104MLAFB: 80 pins)
Operating frequency	32 MHz
Operating voltage	3.3 V
Integrated development	e ² studio 2023-01
environment	IAR EW for RL78 4.21.1
C compiler	C compiler package for RL78 family V1.11.00
	GCC for Renesas RL78 4.9.2.202103
	IAR Toolchain for RL78 4.21.1.2409
Emulator	On-board debugger (E2OB)
Sensor board	Pulse oximetry, proximity, light, and color sensor Pmod™ board (US082- OB1203EVZ)

Table 2-5 Operating Environment for the RL78/G14 Group MCU

Table 2-6 Amount of Memory Used in the RL78/G14 Group MCU

Area	Size
ROM	3,387 bytes
RAM	308 bytes

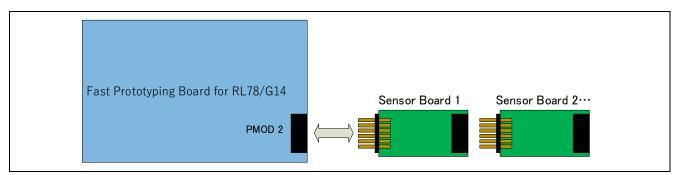


Figure 2-3 Hardware Connections for the RL78/G14 Group



2.4 Environment for Confirming Operation on an RL78/G23 Group MCU

The operation of this software has been confirmed on an MCU of the RL78/G23 group in the following environment.

Item	Description
Demonstration board	RTK7RLG230CSN000BJ (RL78/G23-128p Fast Prototyping Board)
Microcontroller	RL78/G23 (R7F100GSN2DFB: 128 pins)
Operating frequency	32 MHz
Operating voltage	3.3 V
Integrated development	e ² studio 2023-01
environment	IAR EW for RL78 4.21.1
C compiler	C compiler package for RL78 family V1.11.00
	LLVM for RL78 10.0.0.202209
	IAR Toolchain for RL78 4.21.1.2409
Emulator	E2 Lite
Sensor board	Pulse oximetry, proximity, light, and color sensor Pmod™ board (US082- OB1203EVZ)

Table 2-7 Operating Environment for the RL78/G23 Group MCU

Table 2-8 Amount of Memory Used in the RL78/G23 Group MCU

Area	Size
ROM	3,814 bytes
RAM	308 bytes

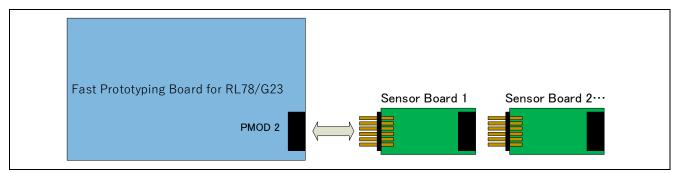


Figure 2-4 Hardware Connections for the RL78/G23 Group



2.5 Environment for Confirming Operation on an RE01 256KB Group MCU

The operation of this software has been confirmed on an MCU of the RE01 256KB group in the following environment.

Item	Description
Demonstration board	EK-RE01 256KB
Microcontroller	RE01 256KB (R7F0E01182CFP: 100 pins)
Operating frequency	32 MHz (HOCO)
Supply voltage to demo board	5V (3.3V generated by regulator on board)
Device operating voltage	3.3V
Integrated development	e ² studio 2022-01
environment	IAR EW for ARM 8.50.9
C compiler	GCC 6.3.1.20170620
	IAR Toolchain for ARM (8.30.x - 8.50.x) 8.1.0.202106261031
	IAR C/C++ Compiler for ARM 8.50.9.278 (8.50.9.278)
Emulator	On-board debugger (J-LINK)
Interposer	DIGILENT Pmod shield adapter
Sensor board	Pulse oximetry, proximity, light, and color sensor Pmod [™] board (US082- OB1203EVZ)

Table 2-9 Operating Environment for the RE01 256KB Group MCU

Table 2-10 Amount of Memory Used in the RE01 256KB Group MCU

Area	Size
ROM	1,872 bytes
RAM	176 bytes

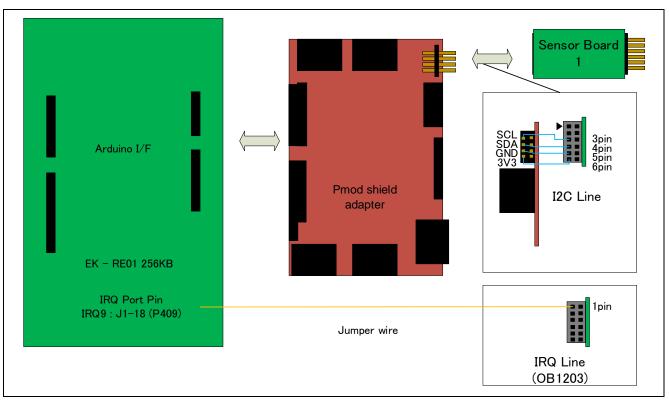


Figure 2-5 Hardware Connections for the RE01 256KB Group



2.6 Environment for Confirming Operation on an RE01 1500KB Group MCU

The operation of this software has been confirmed on an MCU of the RE01 1500KB group in the following environment.

Item	Description
Demonstration board	EK-RE01 1500KB
Microcontroller	RE01 1500KB (R7F0E015DCFB: 144 pins)
Operating frequency	32 MHz (HOCO)
Supply voltage to demo board	5 V (3.3V generated by regulator on board)
Device operating voltage	3.3V
Integrated development	e ² studio 2022-01
environment	IAR EW for ARM 8.50.9
C compiler	GCC 6.3.1.20170620
	IAR Toolchain for ARM (8.30.x - 8.50.x) 8.1.0.202106261031
	IAR C/C++ Compiler for ARM 8.50.9.278 (8.50.9.278)
Emulator	On-board debugger (J-LINK)
Interposer	DIGILENT Pmod shield adapter
Sensor board	Pulse oximetry, proximity, light, and color sensor PMOD™ board (US082-OB1203EVZ)

Table 2-11 Operating Environment for the RE01 1500KB Group MCU

Table 2-12 Amount of Memory Used in the RE01 1500KB Group MCU

Area	Size
ROM	1,872 bytes
RAM	176 bytes

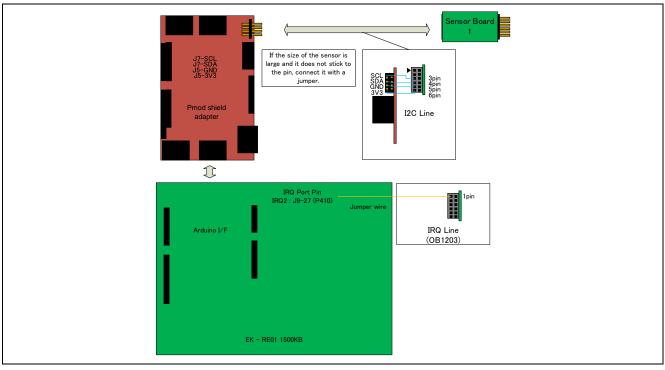


Figure 2-6 Hardware Connections for the RE01 1500KB Group



3. OB1203 Sensor Specifications

3.1 Overview of Sensor Specifications

Table 3-1 gives an overview of the specifications of the OB1203 pulse oximetry, proximity, and light sensor.

The listed values are measured under the international measurement conditions of V_{DD} = 2.8 V and T_{AMB} = 25°C unless specifically stated otherwise.

Symbol	Parameter	Conditions	Minimum	Typical	Maximum	Unit [a]
Power-On	Reset					
PORLH	DC power-on reset	Slow variation of VDD (< 1 ms),		4.0		
POR _{HL} level		TA = 25°C		1.2		V
Current Co	nsumption					
	LS/CS (clear and					
LS	color sensor) active	Default setting; 100% duty cycle;		110		μA
	mode current ^[a]	VDD = 2.8 V; Gain Mode 3				
	PS (proximity sensor)	PS (proximity sensor)				
I _{PS_pk}	active mode peak	Default setting; 100 ms period;		750		μA
	current ^b	VDD = 2.8 V				
	PS (proximity sensor)	Default actting: 100 ma pariod				
PS_avg	active mode average	Default setting; 100 ms period; VDD = 2.8 V		80		μA
_ 0	current ^[b]	VDD = 2.8 V				
1	PPG1 active mode	Default measurement period		730		
PPG1_VDD	VDD average current	and pulse width		730		μA
1	PPG2 active mode	Minimum PPG pulse width and		780		μA
PPG2_VDD	VDD average current	period setting (maximum rate)		700		μΛ
	PPG1 active mode	125 mA LED current setting,				
	LED average current			30		mA
PPG1 LED		period settings				
PPG1_LED		125 mA LED current setting,				
		minimum PPG pulse width and		50		mA
	- 1	period settings (maximum rate)				
		125 mA LED current setting,				
		default PPG pulse width and		48		mA
PPG2 LED	PPG2 active mode	period settings	-			
<pre>PPG2_LED</pre>	LED average current	125 mA LED current setting,				
		minimum PPG pulse width and		43		mA
		period settings (maximum rate)				
	Standby VDD current	The OB1203 is in Standby		-	_	
SBY		Mode; no active I2C		< 2	5	μA
		communication				
I2C Interfa						
VI2Chigh	I2C signal input high		1.26		Vdd	V
V _{12Clow}	I2C signal input low		0		0.54	V
LS Light S	ensor Characteristics					
RESLS	LS output resolution	Programmable to 13, 16, 17, 18,	13	18	20	bit
- 20	•	19, 20 bits	_		-	
	Dark level count	0 lx, 18-bit range		0		count
t∟s	Measurement	Programmable in 8 steps	25		2000	ms
ils	repetition period ^[d]		20		2000	1115
t _{INT}	Measurement	Programmable in 6 steps	50		400	ms
un I	integration period ^{II}		50		400	1115
				C: 9160		
G1	Sensitivity at gain 1	Example for 3050 K, 5 klx LED		R: 3160		counts
0		light, 18-bit sensor resolution.		G: 4280		Counts
				B: 1470		
G3	Sensitivity at gain 3			C: 27480		counts

Table 3-1 Specifications of Sensor Operation



				R: 9480 G: 12840 B: 4410		
G ₆	Sensitivity at gain 6			C: 54960 R: 18960 G: 25680 B: 8820		counts
PS Proximi	ty Sensor Characteris					1
RES _{PS_bit}	Measurement resolution	Depends on pulse width and number of LED pulses	10	15	16	bit
RES _{PS_irr}	Signal strength IR	125 mA LED current; 8 pulse	2830	3300	4030	counts
$RES_{PS_{red}}$	Signal strength Red	average; gain mode 1; 4.6 cm round white reflective target in 4.6 cm distance	2300	2660	3200	counts
ALC _{max}	Ambient light cancellation			>100000		lx
Npulse	Number of LED pulses		1	8	32	
t _{PS}	Measurement period	Programmable in 8 steps		3.125 to 400		ms
t _{PS_pw}	Pulse width	Three possible settings; configurable via register setting		26 42 71		μs
	Analog crosstalk cancellation	Programmable 0 or 50% FS		50%		Full scale
	Digital crosstalk cancellation	Programmable: 0 to full signal level. For 16-bit resolution.	0		65535	count
PPG Chara	cteristics					
RESPPG	Measurement resolution		16	18	18	bit
Appg	Digital averaging factor		1		32	
t PPG	Measurement period	Programmable in 8 steps		0.3125 to 20		ms
tppg_pw	Pulse width	Configurable via register setting		130 247 481 949		μs
	IR counts	18% grey card reflector (6 mm		28000		count
	Red counts	from top of package); sample under clear cover glass; 125 mA LED current; 130 µs LED on time; average over 100 samples per second.		28000		count
	Analog crosstalk cancellation	Programmable 0 or 50% FS		50%		Full scale
	Sample rate accuracy vs. nominal		-2		2	%
Measureme						1
twake-stb	Wake-up time from Standby Mode	From Standby to Active Mode (measurement can start)		1.5		ms
t Start	Start time from VDD apply to Standby Mode			10		ms
R LED (LEI	D1 Pin) Characteristic	۱ <u> </u>				
λPeak	Peak wavelength	$I_{LED} = 100 \text{ mA}, T_{A} = 25^{\circ}\text{C}$		940		nm
I _{IR_LED(Max)}	IR LED current	Programmable in 1024 steps		250		mA
	ED2 Pin) Characterist					



λ _{Peak}	Peak wavelength	$I_{LED} = 20 \text{ mA}, T_A = 25^{\circ}\text{C}$	700	nm
RED_LED(Max)	Red LED current	Programmable in 512 steps	125	mA

- [a] For the LS, the maximum duty cycle is selected with 100ms measurement time (default) and 100ms period at an illumination of 1000 lux.
- [b] For the PS, 100ms measurement period, 42µs pulse width, 8 pulses, 15-bit resolution, and Gain Mode 1 are selected.
- [c] Refer to Figure 16 for typical temperature dependence.
- [d] Typical timing accuracy applied.
- [e] 90 % reflective Kodak R-27.



4. Specifications of Sample Software

This section describes the specifications of the sample software.

4.1 Configuration of the Sample Software

Figure 4-1 shows the configuration of sample software blocks.

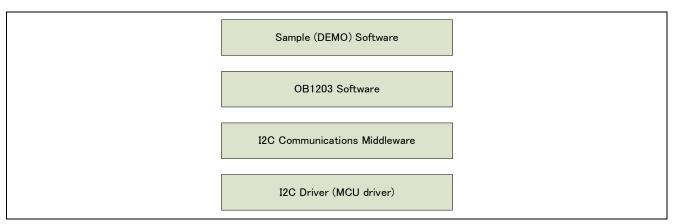


Figure 4-1 Block Diagram of the Sample Software

4.2 Specifications of Sensor API Functions

4.2.1 List of Sensor API Functions

The following table lists the sensor API functions. For details of the API functions, refer to the RA Flexible Software Package Documentation.

Function	Feature
RM_OB1203_Open	Opens the sensor.
RM_OB1203_Close	Closes the sensor.
RM_OB1203_MeasurementStart	Starts measurement by the sensor.
RM_OB1203_MeasurementStop	Stops measurement by the sensor.
RM_OB1203_DeviceStatusGet	Acquires the state of the sensor.
RM_OB1203_DeviceInterruptCfgSet	Sets up interrupt processing.
RM_OB1203_GainSet	Sets the gain.
RM_OB1203_LedCurrentSet	Sets the LED brightness.
RM_OB1203_FifoInfoGet	Reads information from the FIFO.
RM_OB1203_LightRead	Reads raw data from the light sensor (LS).
RM_OB1203_ProxRead	Reads raw data from the proximity sensor (PS).
RM_OB1203_PpgRead	Reads raw data from the photoplethysmography sensor (PPG).
RM_OB1203_LightDataCalculate	Calculates LS values from the raw data read from the sensor.
RM_OB1203_ProxDataCalculate	Calculates PS values from the raw data read from the sensor.
RM_OB1203_PpgDataCalculate	Calculates PPG values from the raw data read from the sensor.

Table 4-1 List of Sensor API Functions



4.2.2 Guide to Using the API Functions

Figure 4-2 is a diagram of transitions between API function calls. This diagram shows the conditions on the usage of the individual API functions and the expected orders of function calls.

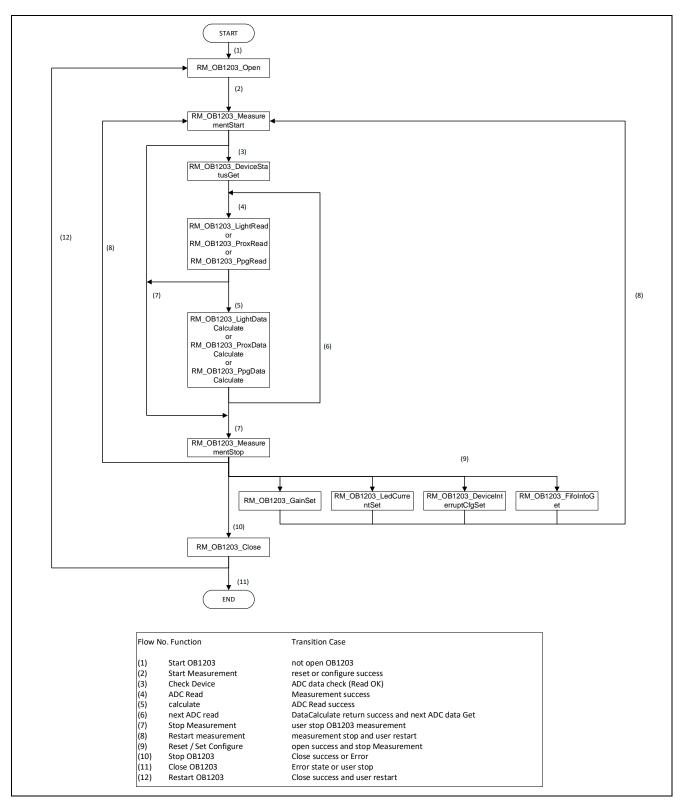


Figure 4-2 Transitions between API Function Calls



The conditions for calling the individual functions are shown below:

- RM_OB1203_Open:	(1) Starting the OB1203
	(12) Restating after a call of RM_OB1203_Close
- RM_OB1203_Close:	(10) Successful completion or abnormal end of
	individual processing
- RM_OB1203_MeasurementStart:	(2) Starting measurement after a call of
	RM_OB1203_Open
	(8) Reading next measured data
- RM_OB1203_MeasurementStop:	(7) Stopping measurement
- RM_OB1203_DeviceStatusGet:	(3) Checking the state of the sensor
- RM_OB1203_DeviceInterruptCfgSet:	(9) Setting the configuration again
- RM_OB1203_GainSet:	(9) Setting the configuration again
- RM_OB1203_LedCurrentSet:	(9) Setting the configuration again
- RM_OB1203_FifoInfoGet: :	(9) Setting the configuration again
- RM_OB1203_xxxxRead:	(4) (6) Reading measured data
- RM_OB1203_xxxxDataCalculate:	(5) Calculating measured data

xxxx is the name or abbreviated name of the target function of the sensor (Light, Prox, or Ppg).

Notes:

Since RM_OB1203_Open checks the state of the I2C driver, the I2C driver must be opened before the RM_OB1203_Open processing.

Regarding how to open the I2C driver, refer to the g_comms_i2c_bus0_quick_setup() function in the sample software. This is not necessary in the RL78 family devices because the I2C driver will be opened in the startup processing.

When using these API functions in an RTOS system, the user will need to control the bus by using a semaphore if the sensor is controlled in multiple threads or tasks at the same time.



4.3 Flowchart of the Main Processing in the Sample Software

The sample software first opens the driver and then repeats the process of starting the measurement by the sensor, acquiring data from the sensor, and calculating values from the results of measurement.

The OS version is controlled by semaphores, and two threads that control the sensor run in parallel.

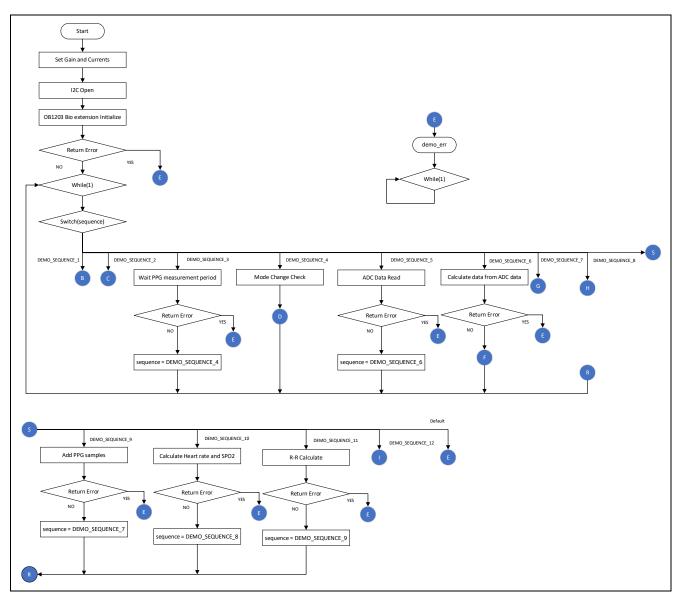


Figure 4-3 Flowchart 1 of the Main Processing in the OB1203 Sample Software



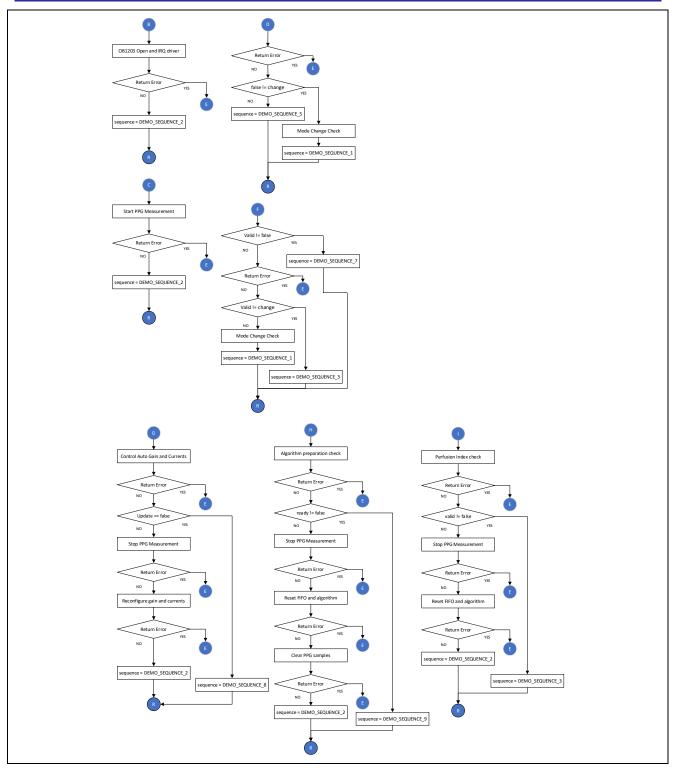


Figure 4-4 Flowchart 2 of the Main Processing in the OB1203 Sample Software



4.3.1 Azure RTOS Project

The RX project for use with the Azure RTOS has the following changes from the default source files generated by the RX Smart Configurator.

1. src/demo_thread.c

Line 57: Addition of extern void tx_application_define_user (void);

Line 177: Addition of tx_application_define_user();



5. Configuration Settings

5.1 OB1203 Sensor Settings

5.1.1 RA Family

Select the rm_ob1203 stack on the [Stack] tabbed page of the FSP Configurator, and the configurable items will be shown on the [Properties] tabbed page.

The following items and values can be specified.

Table 5-1 OB1203 Settings for the RA Family MCU

Configurable Item	Value	Description
Common		
Parameter Checking Module g_ob12 (rm_ob1203)	Default (BSP) Enabled Disabled 203_sensor OB1203 Light/Pro	Specify whether to include the processing to check parameters in the code to be generated. When "Disabled" is selected, the generated code does not include the processing to check parameters. When "Enabled" is selected, the generated code includes the processing to check parameters. ximity/PPG Sensor
Name	g_ob1203_sensor0	Specify the name of the module. A module name conforming to the C language standard can be specified.
Semaphore Timeout (RTOS only)	0xFFFFFFFF	For an RTOS project, specify the time of semaphore timeout.
Comms I2C Callback	ob1203_comms_i2c_callback	Specify the name of the user callback function. A callback function name conforming to the C language standard can be specified. When "NULL" is specified, no callback function is used.
IRQ Callback	ob1203_irq_callback	Specify the name of the IRQ user callback function. A callback function name conforming to the C language standard can be specified. When "NULL" is specified, no callback function is used.

5.1.1.1 Light mode settings

Select the rm_ob1203 Light mode stack in the "Stack" tabbed page of the FSP Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Table 5-2 OB1203 Light mode Settings for RA Family MCU

Configurable Item	Value	Description
Module OB1203	3 Light mode (rm_ob1203)	



Operation Mode	LS mode	Select the measurement mode. Select
	CS mode	ambient light sensor (LS) mode or RGB color sensor (CS) mode.
Interrupt Type	Threshold	Select an interrupt type.
	Variation	
Interrupt Source	Clear channel	Select the interrupt source. Red and blue of
	Green channel	RGB channels are only valid in CS mode.
	Red channel (CS mode only)	
	Blue channel (CS mode only)	
The Number of	0x02	Sets the number of interrupt events. Values
Similar Consecutive Interrupt Events		range from 0x00 to 0x0F.
Sleep after Interrupt	Enabled	Select the Sleep function after interrupting.
	Disabled	
Gain	1	Select the Gain value.
	3	
	6	
Resolution and	Resolution:13bit. Measurement	Select a combination of the resolution of the
Measurement Period	Period:200ms	measurement and the measurement period.
Fenod	Resolution:13bit. Measurement Period:500ms	
	Resolution:13bit. Measurement Period:1000ms	
	Resolution:13bit. Measurement	
	Period:2000ms	
	Resolution:16bit. Measurement	
	Period:25ms	
	Resolution:16bit. Measurement Period:50ms	
	Resolution:16bit. Measurement	
	Period:100ms	
	Resolution:16bit. Measurement Period:200ms	
	Resolution:16bit. Measurement	
	Period:500ms	
	Resolution:16bit. Measurement Period:1000ms	
	Resolution:16bit. Measurement Period:2000ms	
	Resolution:17bit. Measurement Period:50ms	
	Resolution:17bit. Measurement Period:100ms	
	Resolution:17bit. Measurement Period:200ms	
	Resolution:17bit. Measurement Period:500ms	
	Resolution:17bit. Measurement	
	Period:1000ms	
	Resolution:17bit. Measurement	
	Period:2000ms	
	Resolution:18bit. Measurement Period:100ms	
	Resolution:18bit. Measurement Period:200ms	
	Resolution:18bit. Measurement Period:500ms	



	Resolution:18bit. Measurement Period:1000ms	
	Resolution:18bit. Measurement	_
	Period:2000ms	
	Resolution:19bit. Measurement	
	Period:200ms	
	Resolution:19bit. Measurement	
	Period:500ms	
	Resolution:19bit. Measurement	
	Period:1000ms	
	Resolution:19bit. Measurement	
	Period:2000ms	
	Resolution:20bit. Measurement	
	Period:500ms	
	Resolution:20bit. Measurement	
	Period:1000ms	_
	Resolution:20bit. Measurement	
··· ·· · · · · ·	Period:2000ms	
Upper Threshold	0x00CCC	Sets the upper threshold. Any value from
· -· · · · ·		0x00000 to 0xFFFFF is valid.
Lower Threshold	0x00000	Sets the lower threshold. Any value from
· · · · · · · · · · · · · · · · · · ·		0x00000 to 0xFFFFF is valid.
Variance Threshold	+/- 8 counts	Choose to threshold variance.
	+/- 16 counts	
	+/- 32 counts	
	+/- 64 counts	
	+/- 128 counts	
	+/- 256 counts	
	+/- 512 counts	
	+/- 1024 counts	



5.1.1.3 PPG mode settings

Select the rm_ob1203 PPG mode stack in the "Stack" tabbed page of the FSP Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Table 5-3 OB1203 PPG mode Settings for RA Family MCU

Configurable Item	Value	Description	
Module OB1203 PPG mode (rm_ob1203)			
Operation Mode	PPG1 mode	Select the measurement mode. PPG1	
	PPG2 mode	operates with RED or IR, and PPG2	
Interrupt Type	Data	interleaves in IR and RED order.	
Interrupt Type		Select an interrupt type.	
<u> </u>	FIFO Almost Full		
Gain	1	Select the Gain value.	
	1.5		
	2		
	4		
IR LED Current	0x366	Sets the current value of the IR LED. Any value from 0x000 to 0x3FF is valid.	
Red LED Current	0x1B3	Sets the current value of the RED LED. Any value from 0x000 to 0x1FF is valid.	
Power Save Mode	Enabled	Select Power Save Mode on or off.	
	Disabled		
LED Order	IR LED first, Red LED second	Sets the order in which the LEDs are	
	RED LED first, IR LED second	selected.	
IR LED Analog	Enabled (50% offset of the full-scale	Select Enable and disable analog	
Cancellation	value)	cancellation for IR LEDs.	
	Disabled		
Red LED Analog	Enabled (50% offset of the full-scale	Select Enable and disable red LED analog	
Cancellation	value) Disabled	cancellation.	
Number of	1 (No averaging)	Select the number of PPG samples to	
Averaged PPG	2 consecutives samples are	average.	
Samples	averaged	5	
	4 consecutives samples are		
	averaged		
	8 consecutives samples are		
	averaged 16 consecutives samples are		
	averaged		
	32 consecutives samples are averaged		
Pulse Width and	Pulse width:130us. Measurement	Select the pulse width and measurement	
Measurement	Period:0.3125ms (PPG1 mode	period.	
Period	only)		
	Pulse width:130us. Measurement Period:0.625ms		
	Pulse width:130us. Measurement Period:1ms		
	Pulse width:130us. Measurement Period:1.25ms		
	Pulse width:130us. Measurement Period:2.5ms		



	.	
	Pulse width:130us. Measurement]
	Period:5ms	
	Pulse width:130us. Measurement]
	Period:10ms	
	Pulse width:130us. Measurement	
	Period:20ms	
	Pulse width:247us. Measurement	-
	Period:0.625ms (PPG1 mode only)	
	Pulse width:247us. Measurement	-
	Period:1ms	
	Pulse width:247us. Measurement	-
	Period:1.25ms	
	Pulse width:247us. Measurement	1
	Period:2.5ms	
	Pulse width:247us. Measurement	1
	Period:5ms	
	Pulse width:247us. Measurement	1
	Period:10ms	
	Pulse width:247us. Measurement	-
	Period:20ms	
	Pulse width:481us. Measurement	-
	Period:1ms (PPG1 mode only)	
	Pulse width:481us. Measurement	-
	Period:1.25ms (PPG1 mode only)	
	Pulse width:481us. Measurement	-
	Period:2.5ms	
	Pulse width:481us. Measurement	-
	Period:5ms	
	Pulse width:481us. Measurement	-
	Period:10ms	-
	Pulse width:481us. Measurement Period:20ms	
	Pulse width:949us. Measurement	-
	Period:2.5ms (PPG1 mode only)	-
	Pulse width:949us. Measurement	
	Period:5ms	-
	Pulse width:949us. Measurement	
	Period:10ms	-
	Pulse width:949us. Measurement	
	Period:20ms	
FIFO Rollover	Enabled	Choose to enable and disable FIFO
	Disabled	overrides.
FIFO Almost Full	0x0C	Values determines the number of emp
Value		FIFO words when the FIFO almost full
		interrupt is issued.
		Any value from 0x00 to 0x0F is valid.



5.1.1.5 Proximity mode settings

Select the rm_ob1203 Proximity mode stack in the "Stack" tabbed page of the FSP Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Table 5-4 OB1203 Proximity mode Settings for RA Family MCU

Configurable Item	Value	Description	
Module OB1203 Proximity mode (rm_ob1203)			
Interrupt Type	Normal	Select an interrupt type.	
	Logic		
The Number of Similar Consecutive Interrupt Events	0x02	Sets the number of interrupt events. Any value from 0x00 to 0x0F is valid.	
Sleep after Interrupt	Enabled	Selects the sleep feature to be enabled and	
	Disabled	disabled after interrupting.	
Gain	1	Select the Gain value.	
	1.5		
	2		
	4		
LED Current	0x100	Sets the LED current value. Any value from 0x000 to 0x3FF is valid.	
LED Order	IR LED first, Red LED second	Sets the order in which the LEDs are	
	RED LED first, IR LED second	selected.	
LED Analog Cancellation	Enabled (50% offset of the full-scale value)	Choose to enable and disable analog cancellation.	
	Disabled		
LED Digital Cancellation	0x100	Set the digital cancellation value. Any value from 0x0000 to 0xFFFF is valid.	
Number of LED	1 pulses	Select the number of PULSES of LEDs.	
pulses	2 pulses		
	4 pulses		
	8 pulses		
	16 pulses		
	32 pulses		
Pulse Width and Measurement	Pulse width:26us. Measurement Period:3.125ms (except for the	Select the pulse width and measurement period.	
Period	number 32 of LED pulses) Pulse width:26us. Measurement Period:6.25ms		
	Pulse width:26us. Measurement Period:12.5ms		
	Pulse width:26us. Measurement Period:25ms		
	Pulse width:26us. Measurement Period:50ms		
	Pulse width:26us. Measurement Period:100ms		
	Pulse width:26us. Measurement Period:200ms		
	Pulse width:26us. Measurement Period:400ms		



	Pulse width:42us. Measurement Period:3.125ms (except for the number 32 of LED pulses)	
	Pulse width:42us. Measurement Period:6.25ms	
	Pulse width:42us. Measurement Period:12.5ms	
	Pulse width:42us. Measurement Period:25ms	
	Pulse width:42us. Measurement Period:50ms	
	Pulse width:42us. Measurement Period:100ms	
	Pulse width:42us. Measurement Period:200ms	
	Pulse width:42us. Measurement Period:400ms	
Moving Average	Enabled	Choose to use moving averages.
	Disabled	
Hysteresis	0x00	Sets the value of hysteresis. Any value from 0x00 to 0x7F is valid.
Upper Threshold	0x0600	Sets the upper threshold. Any value from 0x0000 to 0xFFFF is valid.
Lower Threshold	0x0000	Sets the lower threshold. Any value from 0x0000 to 0xFFFF is valid.



5.1.1.7 Light Proximity mode settings

Select the rm_ob1203 Light Proximity mode stack in the "Stack" tabbed page of the FSP Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description	
Module OB1203	3 Light Proximity mode (rm_	ob1203)	
General			
Device Interrupt	Light mode	Select the interrupt mode.	
·	Proximity mode	select the interrupt mode.	
1 . 1			
Light mode			
Operation Mode	LS mode	Select the measurement mode. Select	
	CS mode	ambient light sensor (LS) mode or RGB color sensor (CS) mode.	
Interrupt Type	Threshold	Select an interrupt type.	
	Variation		
Interrupt Source	Clear channel	Select the interrupt source. Red and blue of	
·	Green channel	RGB channels are only valid in CS mode.	
	Red channel (CS mode only)	-	
	Blue channel (CS mode only)		
The Number of	0x02	Sets the number of interrupt events. Any	
Similar Consecutive		value from 0x00 to 0x0F is valid.	
Interrupt Events			
Sleep after Interrupt	Enabled	Select the Sleep function after interrupting.	
	Disabled		
Gain	1	Select the Gain value.	
	3		
	6		
Resolution and	Resolution:13bit. Measurement	Select a combination of the resolution of the	
Measurement	Period:200ms	measurement and the measurement period.	
Period	Resolution:13bit. Measurement Period:500ms		
	Resolution:13bit. Measurement	-	
	Period:1000ms		
	Resolution:13bit. Measurement		
	Period:2000ms		
	Resolution:16bit. Measurement Period:25ms		
	Resolution:16bit. Measurement	-	
	Period:50ms		
	Resolution:16bit. Measurement		
	Period:100ms	-	
	Resolution:16bit. Measurement Period:200ms		
	Resolution:16bit. Measurement		
	Period:500ms		
	Resolution:16bit. Measurement		
	Period:1000ms		
	Resolution:16bit. Measurement		
	Period:2000ms		

Table 5-5 OB1203 Light Proximity mode Settings for RA Family MCU



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	Resolution:17bit. Measurement Period:50ms	
	Resolution:17bit. Measurement Period:100ms	
	Resolution:17bit. Measurement Period:200ms	
	Resolution:17bit. Measurement Period:500ms	_
	Resolution:17bit. Measurement Period:1000ms	
	Resolution:17bit. Measurement Period:2000ms	
	Resolution:18bit. Measurement Period:100ms	
	Resolution:18bit. Measurement Period:200ms	
	Resolution:18bit. Measurement Period:500ms	
	Resolution:18bit. Measurement Period:1000ms	
	Resolution:18bit. Measurement Period:2000ms	-
	Resolution:19bit. Measurement Period:200ms	
	Resolution:19bit. Measurement Period:500ms	
	Resolution:19bit. Measurement Period:1000ms	
	Resolution:19bit. Measurement Period:2000ms	
	Resolution:20bit. Measurement Period:500ms	
	Resolution:20bit. Measurement Period:1000ms	
	Resolution:20bit. Measurement Period:2000ms	
Upper Threshold	0x00CCC	Sets the upper threshold. Any value from 0x00000 to 0xFFFFF is valid.
Lower Threshold	0x00000	Sets the lower threshold. Any value from 0x00000 to 0xFFFFF is valid.
Variance Threshold	+/- 8 counts	Choose to threshold variance.
	+/- 16 counts	
	+/- 32 counts	
	+/- 64 counts	
	+/- 128 counts	
	+/- 256 counts	
	+/- 512 counts	
	+/- 1024 counts	
Proximity mode		
Interrupt Type	Normal	Select an interrupt type.
	Logic	
The Number of	0x02	Sets the number of interrupt events. Any
Similar Consecutive Interrupt Events		value from 0x00 to 0x0F is valid.
Sleep after Interrupt	Enabled	Selects the sleep feature to be enabled and
	Disabled	disabled after interrupting.



Gain	1	Select the Gain value.
	1.5	
	2	
	4	
LED Current	0x100	Sets the LED current value. Any value from 0x000 to 0x3FF is valid.
LED Order	IR LED first, Red LED second	Sets the order in which the LEDs are
	RED LED first, IR LED second	selected.
LED Analog Cancellation	Enabled (50% offset of the full-scale value) Disabled	Choose to enable and disable analog cancellation.
LED Digital Cancellation	0x100	Set the digital cancellation value. Any value from 0x0000 to 0xFFFF is valid.
Number of LED	1 pulses	Select the number of PULSES of LEDs.
pulses	2 pulses	-
	4 pulses	-
	8 pulses	
	16 pulses	
	32 pulses	-
Pulse Width and Measurement	Pulse width:26us. Measurement Period:3.125ms (except for the	Select the pulse width and measurement period.
Period	number 32 of LED pulses) Pulse width:26us. Measurement	-
	Period:6.25ms Pulse width:26us. Measurement	-
	Period:12.5ms Pulse width:26us. Measurement	
	Period:25ms Pulse width:26us. Measurement	-
	Period:50ms Pulse width:26us. Measurement	-
	Period:100ms	
	Pulse width:26us. Measurement Period:200ms	
	Pulse width:26us. Measurement Period:400ms	
	Pulse width:42us. Measurement Period:3.125ms (except for the number 32 of LED pulses)	
	Pulse width:42us. Measurement Period:6.25ms	
	Pulse width:42us. Measurement Period:12.5ms	_
	Pulse width:42us. Measurement Period:25ms	
	Pulse width:42us. Measurement Period:50ms	
	Pulse width:42us. Measurement Period:100ms	
	Pulse width:42us. Measurement Period:200ms	-
<u>.</u>	Pulse width:42us. Measurement Period:400ms	
Moving Average	Enabled Disabled	Choose to use moving averages.
	Disableu	



Hysteresis	0x00	Sets the value of hysteresis. Any value from 0x00 to 0x7F is valid.
Upper Threshold	0x0600	Sets the upper threshold. Any value from 0x0000 to 0xFFFF is valid.
Lower Threshold	0x0000	Sets the lower threshold. Any value from 0x0000 to 0xFFFF is valid.



5.1.2 RX Family

Select the r_ob1203_rx component on the [Component] tabbed page of the Smart Configurator, and the configurable items will be shown in the [Configure] panel.

The following items and values can be specified.

Table 5-6 OB1203 Settings for the RX Family MCU

Constant Name	Value	Description
Configurations		
RM_OB1203_CFG_PARA M_CHECKING_ENABLE	0 1	Specify whether to include the processing to check parameters in the code to be generated. When "0" is specified, the generated code does not include the processing to check parameters. When "1" is specified, the generated code includes the processing to check parameters.
RM_OB1203_CFG_DEVIC	1	Specify the number of OB1203 sensors.
E_NUM_MAX	2	
RM_OB1203_CFG_DEVIC	0	Specify OB1203 sensor operation mode.
E(x)_SENSOR_MODE	1	0: Not selected
(x = 0 - 1)	2	1: Light Sensor mode
· · · ·	3	2: Proximity Sensor mode 3: Light Proximity Sensor mode
	4	4: PPG Sensor mode
RM_OB1203_CFG_DEVIC	g_comms_i2c_device(y)	Specify the communications device
$E(x)_COMMS_INSTANCE$ (x = 0 - 1)	(y = 0 - 4)	number to be used by the sensor.
RM_OB1203_CFG_DEVIC E(x)_COMMS_I2C_CALLB ACK (x = 0 - 1)	ob1203_user_i2c_callback0	Specify the name of the I2C callback function.
RM_OB1203_CFG_DEVIC E(x)_IRQ_CALLBACK (x = 0 - 1)	ob1203_user_irq_callback0	Specify the name of the external interrupt (IRQ) callback function.
$RM_OB1203_CFG_DEVIC$ E(x)_IRQ_NUMBER (x = 0 - 1)	IRQ(y) (y = 0 - 15)	Specify the number of the external interrupt (IRQ) pin.
RM_OB1203_CFG_DEVIC E(x)_IRQ_TRIGGER	IRQ_TRIG_FALLING	Specify the trigger of the external interrupt (IRQ) pin.
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC E(x)_IRQ_ PRIORITY	IRQ_PRI_(y) (y = 0 - 15)	Specify the priority of the external interrupt (IRQ) pin.
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC E(x)_SEMAPHORE_TIME OUT	0xFFFFFFF	Specify the semaphore timeout.
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC E(x)_LIGHT_PROX_DEVIC	RM_OB1203_OPERATION_M ODE_LIGHT	Specify OB1203 device interrupt.



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$E_{INTERRUPT}$ (x = 0 - 1)	RM_OB1203_OPERATION_M ODE_PROXIMITY	
RM_OB1203_CFG_DEVIC E(x)_PPG_PROX_GAIN (x = 0 - 1)	RM_OB1203_PPG_PROX_GAIN _1 RM_OB1203_PPG_PROX_GAIN _1P5 RM_OB1203_PPG_PROX_GAIN _2	Specify gain for PPG/Proximity Sensor mode.
	RM_OB1203_PPG_PROX_GAIN	
RM_OB1203_CFG_DEVIC E(x)_LED_ORDER (x = 0 - 1)	RM_OB1203_LED_IR_FIRST RED_SECOND RM_OB1203_LED_RED_FIRS T_IR_SECOND	Specify LED order.
$\begin{array}{l} RM_OB1203_CFG_DEVIC\\ E(x)_LIGHT_SENSOR_MO\\ DE\\ (x=0-1) \end{array}$	RM_OB1203_LIGHT_SENSO R_MODE_LS RM_OB1203_LIGHT_SENSO R_MODE_CS	Specify operation mode for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_INTERRUPT_ TYPE (x = 0 - 1)	RM_OB1203_LIGHT_INTERR UPT_TYPE_THRESHOLD RM_OB1203_LIGHT_INTERR UPT_TYPE_VARIATION	Specify interrupt type for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_INTERRUPT_ SOURCE (x = 0 – 1)	RM_OB1203_LIGHT_INTERR UPT_SOURCE_CLEAR_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL	Specify interrupt source for Light Sensor mode. (* Only CS mode)
RM_OB1203_CFG_DEVIC E(x)_LIGHT_INTERRUPT_ PERSIST (x = 0 - 1)	0x0 to 0x0F	Specify number of similar consecutive interrupt events for Light Senser mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_SLEEP_AFTE R_INTERRUPT (x = 0 - 1)	RM_OB1203_SLEEP_AFTER _INTERRUPT_DISABLE RM_OB1203_SLEEP_AFTER _INTERRUPT_ENABLE	Specify sleep after interrupt for Light Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_LIGHT_GAIN \\ (x=0-1) \end{array}$	RM_OB1203_LIGHT_GAIN_1 RM_OB1203_LIGHT_GAIN_3 RM_OB1203_LIGHT_GAIN_6	Specify gain for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_RESOLUTIO N_PERIOD (x = 0 - 1)	RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_25MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_50MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_100MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_200MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_500MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_1000MS	Specify resolution and measurement period for Light Sensor mode.



		RM_OB1203_LIGHT_RESOLUTI	
		ON_13BIT_PERIOD_2000MS RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_25MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_50MS RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_100MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_200MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_500MS RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_1000MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_16BIT_PERIOD_2000MS	
		RM_OB1203_LIGHT_RESOLUTI ON_17BIT_PERIOD_50MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_17BIT_PERIOD_100MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_17BIT_PERIOD_200MS	
		RM_OB1203_LIGHT_RESOLUTI ON_17BIT_PERIOD_500MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_17BIT_PERIOD_1000MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_17BIT_PERIOD_2000MS RM_OB1203_LIGHT_RESOLUTI	
		ON_18BIT_PERIOD_100MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_18BIT_PERIOD_200MS	
		RM_OB1203_LIGHT_RESOLUTI ON_18BIT_PERIOD_500MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_18BIT_PERIOD_1000MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_18BIT_PERIOD_2000MS	
		RM_OB1203_LIGHT_RESOLUTI ON_19BIT_PERIOD_200MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_19BIT_PERIOD_500MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_19BIT_PERIOD_1000MS RM_OB1203_LIGHT_RESOLUTI	
		ON_19BIT_PERIOD_2000MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_20BIT_PERIOD_500MS	
		RM_OB1203_LIGHT_RESOLUTI ON_20BIT_PERIOD_1000MS	
		RM_OB1203_LIGHT_RESOLUTI	
		ON_20BIT_PERIOD_2000MS	
	M_OB1203_CFG_DEVIC	0x00000 to 0xFFFFF	Specify upper threshold of threshold
	0_LIGHT_UPPER_THRE		interrupt for Light Sensor mode.
	(HOLD)		
()	< = 0 − 1)		
	M_OB1203_CFG_DEVIC	0x00000 to 0xFFFFF	Specify lower threshold of threshold
	(x)_LIGHT_LOWER_THR		interrupt for Light Sensor mode.
	SHOLD		
·	< = 0 − 1)		
	M_OB1203_CFG_DEVIC	RM_OB1203_VARIANCE_TH	Specify variance threshold of variance
E	(x)_LIGHT_VARIANCE_T	RESHOLD_8_COUNTS	interrupt for Light Sensor mode.



•		· · ·
HRESHOLD (x = 0 - 1) RM_OB1203_CFG_DEVIC E(x)_PROX_INTERRUPT_	RM_OB1203_VARIANCE_TH RESHOLD_16_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_32_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_64_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_128_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_256_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_512_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_1024_COUNTS RM_OB1203_PROX_INTERR UPT_TYPE_NORMAL	Specify interrupt type for Proximity Sensor mode.
TYPE (x = 0 - 1)	RM_OB1203_PROX_INTERR UPT_TYPE_LOGIC	
RM_OB1203_CFG_DEVIC E(x)_PROX_INTERRUPT_ PERSIST	0x0 to 0xF	Specify number of similar consecutive interrupt events for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_SLEEP_AFTE R_INTERRUPT (x = 0 - 1)	RM_OB1203_SLEEP_AFTER _INTERRUPT_DISABLE RM_OB1203_SLEEP_AFTER _INTERRUPT_ENABLE	Specify sleep after interrupt for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_LED_CURRE NT (x = 0 - 1)	0x000 to 0x3FF	Specify LED current for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_ANA_CAN (x = 0 - 1)	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify LED analog cancellation for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_DIG_CAN (x = 0 - 1)	0x0000 to 0xFFFF	Specify LED digital cancellation for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_NUM_LED_P ULSES (x = 0 - 1)	RM_OB1203_NUM_LED_PUL SES_1 RM_OB1203_NUM_LED_PUL SES_2 RM_OB1203_NUM_LED_PUL SES_4 RM_OB1203_NUM_LED_PUL SES_8 RM_OB1203_NUM_LED_PUL SES_16 RM_OB1203_NUM_LED_PUL SES_32	Specify number of LED pulses for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_WIDTH_PERI OD (x = 0 - 1)	RM_OB1203_PROX_WIDTH_ 26US_PERIOD_3P125MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_6P25MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_12P5MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_25MS	Specify pulse width and measurement period for Proximity Sensor mode.



	RM_OB1203_PROX_WIDTH_	
	26US_PERIOD_50MS	
	RM_OB1203_PROX_WIDTH_	
	26US PERIOD 100MS	
	RM OB1203 PROX WIDTH	
	26US_PERIOD_200MS	
	RM_OB1203_PROX_WIDTH_	
	26US_PERIOD_400MS	
	RM_OB1203_PROX_WIDTH_	
	42US PERIOD 3P125MS	
	RM OB1203 PROX WIDTH	
	42US_PERIOD_6P25MS	
	RM OB1203 PROX WIDTH	
	42US_PERIOD_12P5MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_25MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_50MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_100MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_200MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_400MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_3P125MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_6P25MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_12P5MS	
	RM OB1203 PROX WIDTH	
	71US_PERIOD_25MS	
	RM_OB1203_PROX_WIDTH_	
	71US PERIOD 50MS	
	RM OB1203 PROX WIDTH	
	71US PERIOD 100MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_200MS	
	RM OB1203 PROX WIDTH	
	71US_PERIOD_400MS	
RM OB1203 CFG DEVIC	RM_OB1203_MOVING_AVER	Specify moving average for Proximity
E(x) PROX MOVING AV	AGE_DISABLE	Sensor mode.
ERAGE	RM_OB1203_MOVING_AVER	
(x = 0 - 1)	AGE_ENABLE	
· · · ·		
RM_OB1203_CFG_DEVIC	0x00 to 0x7F	Specify hysteresis for Proximity Sensor
E(x)0_PROX_HYSTERESI		mode.
S		
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC	0x0000 to 0xFFFF	Specify upper threshold of threshold
E(x)_PROX_UPPER_THR		interrupt for Proximity Sensor mode.
ESHOLD		interrupt for Froximity Gensor mode.
(x = 0 - 1)		
(- 0 - 1)		
RM_OB1203_CFG_DEVIC	0x0000 to 0xFFFF	Specify lower threshold of threshold
E(x)_PROX_LOWER_THR		interrupt for Proximity Sensor mode.
ESHOLD		
(x = 0 - 1)		



$ \begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_PPG_SENSOR_MOD \\ E \\ (x = 0 - 1) \end{array} $	RM_OB1203_PPG_SENSOR_ MODE_PPG1 RM_OB1203_PPG_SENSOR_ MODE_PPG2	Specify operation mode for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_INTERRUPT_T YPE (x = 0 - 1)	RM_OB1203_PPG_INTERRU PT_TYPE_DATA RM_OB1203_PPG_INTERRU PT_TYPE_FIFO_AFULL	Specify interrupt type of PPG Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_PPG_IR_LED_CURR \\ ENT \\ (x = 0 - 1) \end{array}$	0x000 to 0x3FF	Specify IR LED current for PPG Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_PPG_RED_LED_CU \\ RRENT \\ (x = 0 - 1) \end{array}$	0x000 to 0x1FF	Specify Red LED current for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_POWER_SAVE _MODE (x = 0 - 1)	RM_OB1203_POWER_SAVE _MODE_DISABLE RM_OB1203_POWER_SAVE _MODE_ENABLE	Specify power same mode for PPG Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_PPG_IR_LED_ANA_ \\ CAN \\ (x = 0 - 1) \end{array}$	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify IR LED analog cancellation for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_RED_LED_ANA _CAN (x = 0 - 1)	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify Red LED analog cancellation for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_NUM_AVERAG ED_SAMPLES (x = 0 - 1)	RM_OB1203_NUM_AVERAG ED_SAMPLES_1 RM_OB1203_NUM_AVERAG ED_SAMPLES_2 RM_OB1203_NUM_AVERAG ED_SAMPLES_4 RM_OB1203_NUM_AVERAG ED_SAMPLES_8 RM_OB1203_NUM_AVERAG ED_SAMPLES_16 RM_OB1203_NUM_AVERAG ED_SAMPLES_32	Specify number of averaged PPG samples for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_WIDTH_PERIO D (x = 0 - 1)	RM_OB1203_PPG_WIDTH_1 30US_PERIOD_0P3125MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_0P625MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_1MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_1P25MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_5MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_10MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_20MS	Specify pulse width and measurement period for PPG Sensor mode.



	RM_OB1203_PPG_WIDTH_2 47US_PERIOD_0P625MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_1MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_10MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_20MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_1MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_1P25MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_20MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_20MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_25MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_5MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_10MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_25MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_10MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_20MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_20MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_5MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_5MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_5MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_10MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_10MS RM_OB1203_PPG_WIDTH_9 49US_PERIOD_10MS	Specify EIEO rollover for DDC Sensor
RM_OB1203_CFG_DEVIC E(x)_PPG_FIFO_ROLLOV ER (x = 0 - 1)		Specify FIFO rollover for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_FIFO_EMPTY_ NUM (x = 0 - 1)	0x0 to 0x0F	Specify FIFO almost full value for PPG Sensor mode.



5.1.3 RL78 Family

Settings can be modified by changing the values of constants defined in the $r_config_r_ob1203_rl_config.h$ file in the project tree of the sample project.

The following items and values can be specified.

Table 5-7 OB1203 Settings for the RL78 Family MCU

Constant Name	Value	Description
Configurations		
RM_OB1203_CFG_PARA M_CHECKING_ENABLE	0 1	Specify whether to include the processing to check parameters in the code to be generated. When "0" is specified, the generated code does not include the processing to check parameters. When "1" is specified, the generated
		code includes the processing to check parameters.
RM_OB1203_CFG_DEVIC	1	Specify the number of OB1203 sensors.
E_NUM_MAX	2	
RM_OB1203_CFG_DEVIC	0	Specify OB1203 sensor operation mode.
E(x)_SENSOR_MODE	1	0: Not selected 1: Light Sensor mode
(x = 0 - 1)	2	2: Proximity Sensor mode
	3	3: Light Proximity Sensor mode
	4	4: PPG Sensor mode
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_COMMS_INSTANCE \\ (x = 0 - 1) \end{array}$	$g_comms_i2c_device(y)$ (y = 0 - 4)	Specify the communications device number to be used by the sensor.
$\begin{array}{l} RM_OB1203_CFG_DEVIC\\ E(x)_COMMS_12C_CALLB\\ ACK\\ (x=0-1) \end{array}$	Ob1203_user_i2c_callback0	Specify the name of the I2C callback function.
RM_OB1203_CFG_DEVIC	Disable	Enable or disable external interrupts
$E(x)_IRQ_ENABLE$ (x = 0 - 1)	Enabled	(INTC).
RM_OB1203_CFG_DEVIC E(x)_IRQ_CALLBACK (x = 0 - 1)	ob1203_user_irq_callback0	Specify the name of the external interrupt (INTC) callback function.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_IRQ_NUMBER \\ (x = 0 - 1) \end{array}$	INTC(y) (y = 0 - 11)	Specify the number of the external interrupt (INTC) pin.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_LIGHT_PROX_DEVIC \\ E_INTERRUPT \\ (x = 0 - 1) \end{array}$	RM_OB1203_OPERATION_M ODE_LIGHT RM_OB1203_OPERATION_M ODE_PROXIMITY	Specify OB1203 device interrupt.
RM_OB1203_CFG_DEVIC	RM_OB1203_PPG_PROX_GAIN _1	Specify gain for PPG/Proximity Sensor
$E(x)_PPG_PROX_GAIN$ $(x = 0 - 1)$	RM_OB1203_PPG_PROX_GAIN _1P5	mode.
	RM_OB1203_PPG_PROX_GAIN _2	
	RM_OB1203_PPG_PROX_GAIN _4	



RM_OB1203_CFG_DEVIC E(x)_LED_ORDER (x = 0 - 1)	RM_OB1203_LED_IR_FIRST _RED_SECOND RM_OB1203_LED_RED_FIRS T_IR_SECOND	Specify LED order.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_SENSOR_MO DE (x = 0 - 1)	RM_OB1203_LIGHT_SENSO R_MODE_LS RM_OB1203_LIGHT_SENSO R_MODE_CS	Specify operation mode for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_INTERRUPT_ TYPE (x = 0 - 1)	RM_OB1203_LIGHT_INTERR UPT_TYPE_THRESHOLD RM_OB1203_LIGHT_INTERR UPT_TYPE_VARIATION	Specify interrupt type for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_INTERRUPT_ SOURCE (x = 0 - 1)	RM_OB1203_LIGHT_INTERR UPT_SOURCE_CLEAR_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL RM_OB1203_LIGHT_INTERR UPT_SOURCE_GREEN_CHA NNEL	Specify interrupt source for Light Sensor mode. (* Only CS mode)
$\begin{array}{l} RM_OB1203_CFG_DEVIC\\ E(x)_LIGHT_INTERRUPT\\ PERSIST\\ (x=0-1) \end{array}$	0x0 to 0x0F	Specify number of similar consecutive interrupt events for Light Senser mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC\\ E(x)_LIGHT_SLEEP_AFTE\\ R_INTERRUPT\\ (x=0-1) \end{array}$	RM_OB1203_SLEEP_AFTER _INTERRUPT_DISABLE RM_OB1203_SLEEP_AFTER _INTERRUPT_ENABLE	Specify sleep after interrupt for Light Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_LIGHT_GAIN \\ (x=0-1) \end{array}$	RM_OB1203_LIGHT_GAIN_1 RM_OB1203_LIGHT_GAIN_3 RM_OB1203_LIGHT_GAIN_6	Specify gain for Light Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_LIGHT_RESOLUTIO N_PERIOD (x = 0 - 1)	RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_25MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_50MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_100MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_200MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_500MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_1000MS RM_OB1203_LIGHT_RESOLUTI ON_13BIT_PERIOD_200MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_25MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_50MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_50MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_100MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_100MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_200MS RM_OB1203_LIGHT_RESOLUTI ON_16BIT_PERIOD_200MS	Specify resolution and measurement period for Light Sensor mode.



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	RM_OB1203_LIGHT_RESOLUTI	
	ON_16BIT_PERIOD_1000MS RM_0B1203_LIGHT_RESOLUTI	
	ON_16BIT_PERIOD_2000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_17BIT_PERIOD_50MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_17BIT_PERIOD_100MS	
	RM_OB1203_LIGHT_RESOLUTI ON_17BIT_PERIOD_200MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_17BIT_PERIOD_500MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_17BIT_PERIOD_1000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_17BIT_PERIOD_2000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_18BIT_PERIOD_100MS RM OB1203 LIGHT RESOLUTI	
	ON_18BIT_PERIOD_200MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_18BIT_PERIOD_500MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_18BIT_PERIOD_1000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_18BIT_PERIOD_2000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_19BIT_PERIOD_200MS RM_OB1203_LIGHT_RESOLUTI	
	ON_19BIT_PERIOD_500MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_19BIT_PERIOD_1000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_19BIT_PERIOD_2000MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_20BIT_PERIOD_500MS	
	RM_OB1203_LIGHT_RESOLUTI	
	ON_20BIT_PERIOD_1000MS RM_OB1203_LIGHT_RESOLUTI	
	ON_20BIT_PERIOD_2000MS	
RM_OB1203_CFG_DEVIC	0x00000 to 0xFFFFF	Specify upper threshold of threshold
E0_LIGHT_UPPER_THRE		interrupt for Light Sensor mode.
SHOLD		
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC	0x00000 to 0xFFFFF	Specify lower threshold of threshold
E(x)_LIGHT_LOWER_THR		interrupt for Light Sensor mode.
ESHOLD		
(x = 0 - 1)		
	DM OD4202 MADIANCE TH	Chapter wariance threaded of variance
RM_OB1203_CFG_DEVIC	RM_OB1203_VARIANCE_TH	Specify variance threshold of variance
E(x)_LIGHT_VARIANCE_T	RESHOLD_8_COUNTS	interrupt for Light Sensor mode.
HRESHOLD $(x = 0, -1)$	RM_OB1203_VARIANCE_TH	
(x = 0 - 1)	RESHOLD_16_COUNTS	
	RM_OB1203_VARIANCE_TH	
	RESHOLD_32_COUNTS	
	RM_OB1203_VARIANCE_TH	
	RESHOLD_64_COUNTS	
	RM_OB1203_VARIANCE_TH	
	RESHOLD_128_COUNTS	
	RM_OB1203_VARIANCE_TH	
	RESHOLD_256_COUNTS	
	RESHOLD_236_COUNTS RM_OB1203_VARIANCE_TH RESHOLD_512_COUNTS	



	RM_OB1203_VARIANCE_TH RESHOLD_1024_COUNTS	
RM_OB1203_CFG_DEVIC E(x)_PROX_INTERRUPT_ TYPE (x = 0 - 1)	RM_OB1203_PROX_INTERR UPT_TYPE_NORMAL RM_OB1203_PROX_INTERR UPT_TYPE_LOGIC	Specify interrupt type for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_INTERRUPT_ PERSIST	0x0 to 0xF	Specify number of similar consecutive interrupt events for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_SLEEP_AFTE R_INTERRUPT (x = 0 - 1)	RM_OB1203_SLEEP_AFTER _INTERRUPT_DISABLE RM_OB1203_SLEEP_AFTER _INTERRUPT_ENABLE	Specify sleep after interrupt for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_LED_CURRE NT (x = 0 - 1)	0x000 to 0x3FF	Specify LED current for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_ANA_CAN (x = 0 - 1)	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify LED analog cancellation for Proximity Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC \\ E(x)_PROX_DIG_CAN \\ (x = 0 - 1) \end{array}$	0x0000 to 0xFFFF	Specify LED digital cancellation for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_NUM_LED_P ULSES (x = 0 - 1)	RM_OB1203_NUM_LED_PUL SES_1 RM_OB1203_NUM_LED_PUL SES_2 RM_OB1203_NUM_LED_PUL SES_4 RM_OB1203_NUM_LED_PUL SES_8 RM_OB1203_NUM_LED_PUL SES_16 RM_OB1203_NUM_LED_PUL SES_32	Specify number of LED pulses for Proximity Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PROX_WIDTH_PERI OD (x = 0 - 1)	RM_OB1203_PROX_WIDTH_ 26US_PERIOD_3P125MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_6P25MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_12P5MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_25MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_50MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_100MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_200MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_400MS RM_OB1203_PROX_WIDTH_ 26US_PERIOD_400MS RM_OB1203_PROX_WIDTH_ 42US_PERIOD_3P125MS RM_OB1203_PROX_WIDTH_ 42US_PERIOD_6P25MS	Specify pulse width and measurement period for Proximity Sensor mode.



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	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_12P5MS RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_25MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_50MS RM_OB1203_PROX_WIDTH_	
	42US PERIOD 100MS	
	RM_OB1203_PROX_WIDTH_	
	42US_PERIOD_200MS	
	RM_OB1203_PROX_WIDTH_ 42US_PERIOD_400MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_3P125MS	
	RM_OB1203_PROX_WIDTH_ 71US_PERIOD_6P25MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_12P5MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_25MS	
	RM_OB1203_PROX_WIDTH_ 71US_PERIOD_50MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_100MS	
	RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_200MS RM_OB1203_PROX_WIDTH_	
	71US_PERIOD_400MS	
RM_OB1203_CFG_DEVIC	RM_OB1203_MOVING_AVER	Specify moving average for Proximity
E(x)_PROX_MOVING_AV	AGE_DISABLE	Sensor mode.
ERAGE $(x = 0, 1)$	RM_OB1203_MOVING_AVER	
(x = 0 - 1)	AGE_ENABLE	
RM_OB1203_CFG_DEVIC	0x00 to 0x7F	Specify hysteresis for Proximity Sensor
E(x)0_PROX_HYSTERESI S		mode.
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC	0x0000 to 0xFFFF	Specify upper threshold of threshold
E(x)_PROX_UPPER_THR		interrupt for Proximity Sensor mode.
ESHOLD		······································
(x = 0 - 1)		
RM_OB1203_CFG_DEVIC	0x0000 to 0xFFFF	Specify lower threshold of threshold
E(x)_PROX_LOWER_THR		interrupt for Proximity Sensor mode.
ESHOLD $(x = 0 - 1)$		
· · · · ·		
RM_OB1203_CFG_DEVIC E(x)_PPG_SENSOR_MOD	RM_OB1203_PPG_SENSOR_ MODE PPG1	Specify operation mode for PPG Sensor mode.
E	RM_OB1203_PPG_SENSOR_	
(x = 0 - 1)	MODE_PPG2	
RM_OB1203_CFG_DEVIC	RM_OB1203_PPG_INTERRU	Specify interrupt type of PPG Sensor
E(x)_PPG_INTERRUPT_T	PT_TYPE_DATA	mode.
YPE(x = 0 - 1)	RM_OB1203_PPG_INTERRU	
	PT_TYPE_FIFO_AFULL	Specify ID ED current for DDC Constant
RM_OB1203_CFG_DEVIC E(x)_PPG_IR_LED_CURR	0x000 to 0x3FF	Specify IR LED current for PPG Sensor mode.
(x = 0 - 1)		
		L



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RM_OB1203_CFG_DEVIC E(x)_PPG_RED_LED_CU RRENT (x = 0 - 1)	0x000 to 0x1FF	Specify Red LED current for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_POWER_SAVE _MODE (x = 0 - 1)	RM_OB1203_POWER_SAVE _MODE_DISABLE RM_OB1203_POWER_SAVE _MODE_ENABLE	Specify power same mode for PPG Sensor mode.
$\begin{array}{l} RM_OB1203_CFG_DEVIC\\ E(x)_PPG_IR_LED_ANA_\\ CAN\\ (x=0-1) \end{array}$	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify IR LED analog cancellation for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_RED_LED_ANA _CAN (x = 0 - 1)	RM_OB1203_ANALOG_CAN CELLATION_DISABLE RM_OB1203_ANALOG_CAN CELLATION_ENABLE	Specify Red LED analog cancellation for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_NUM_AVERAG ED_SAMPLES (x = 0 - 1)	RM_OB1203_NUM_AVERAG ED_SAMPLES_1 RM_OB1203_NUM_AVERAG ED_SAMPLES_2 RM_OB1203_NUM_AVERAG ED_SAMPLES_4 RM_OB1203_NUM_AVERAG ED_SAMPLES_8 RM_OB1203_NUM_AVERAG ED_SAMPLES_16 RM_OB1203_NUM_AVERAG ED_SAMPLES_32	Specify number of averaged PPG samples for PPG Sensor mode.
RM_OB1203_CFG_DEVIC E(x)_PPG_WIDTH_PERIO D (x = 0 - 1)	RM_OB1203_PPG_WIDTH_1 30US_PERIOD_0P3125MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_0P625MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_1MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_1P25MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_5MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_10MS RM_OB1203_PPG_WIDTH_1 30US_PERIOD_20MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_0P625MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_1MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_1MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_1MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_1P25MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_5MS RM_OB1203_PPG_WIDTH_2 47US_PERIOD_5MS	Specify pulse width and measurement period for PPG Sensor mode.



	47US_PERIOD_20MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_1MS RM_OB1203_PPG_WIDTH_4	
	81US_PERIOD_1P25MS RM_OB1203_PPG_WIDTH_4	
	81US_PERIOD_2P5MS RM_OB1203_PPG_WIDTH_4	
	81US_PERIOD_5MS RM_OB1203_PPG_WIDTH_4 81US_PERIOD_10MS	
	RM_OB1203_PPG_WIDTH_4 81US_PERIOD_20MS	
	RM_OB1203_PPG_WIDTH_9 49US_PERIOD_2P5MS	
	RM_OB1203_PPG_WIDTH_9 49US_PERIOD_5MS	
	RM_OB1203_PPG_WIDTH_9 49US_PERIOD_10MS	
	RM_OB1203_PPG_WIDTH_9 49US_PERIOD_20MS	
RM_OB1203_CFG_DEVIC E(x)_PPG_FIFO_ROLLOV ER	RM_OB1203_FIFO_ROLLOV ER_DISABLE RM_OB1203_FIFO_ROLLOV	Specify FIFO rollover for PPG Sensor mode.
(x = 0 – 1) RM_OB1203_CFG_DEVIC	ER_ENABLE 0x0 to 0x0F	Specify FIFO almost full value for PPG
$E(x)_PPG_FIFO_EMPTY_NUM$ (x = 0 - 1)		Sensor mode.



5.1.4 RE01 256KB or 1500KB Group

Select the rm_ob1203 stack on the [Stacks] tabbed page of the SDK Configurator, and the configurable items will be shown on the [Properties] tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description		
Common				
Parameter Checking	Default (BSP) Enabled Disabled	Specify whether to include the processing to check parameters in the code to be generated. When "Disabled" is selected, the generated code does not include the processing to check parameters. When "Enabled" is selected, the generated code includes the processing to check parameters.		
(rm_ob1203)	203_sensor OB1203 Light/Pro	oximity/PPG Sensor		
Name	g_ob1203_sensor0	Specify the name of the module. A module name conforming to the C language standard can be specified.		
Semaphore Timeout (RTOS only)	0xFFFFFFF	For an RTOS project, specify the time of semaphore timeout.		
Comms I2C Callback	ob1203_comms_i2c_callback	Specify the name of the user callback function. A callback function name conforming to the C language standard can be specified. When "NULL" is specified, no callback function is used.		
IRQ Enable	Disable	Enable IRQ interrupts. When "Enable" is		
	Enable	selected, jumper settings on the board and interrupt settings through the SDK Configurator are required. The configuration method is described below.*		
IRQ Callback	ob1203_irq_callback	Specify the name of the IRQ user callback function. A callback function name conforming to the C language standard can be specified. When "NULL" is specified, no callback function is used.		

Note: * OB1203 IRQ interrupt settings are added through the SDK Configurator.



1. Set "IRQ Enable" to "Enable" in the properties of the g_ob1203_sensor OB1203 Light/Proximity/PPG Sensor on the [Stacks] tabbed page.

8					\times
= プロパティ	- ×			1	8
g_ob1203	3_sensor0 OB1203 Light/Proximity/PPG Sensor (rm_ob1203)				
Settings	プロパティ Y Common	値			
	Parameter Checking	Default (BSP)			
	➤ Module g_ob1203_sensor0 OB1203 Light/Proximity/PPG Sensor (rm_c				
	Name	g_ob1203_sensor0			
	Semaphore Timeout (RTOS only)	OxFFFFFFFF			
	Comms I2C Callback	ob1203_comms_i2c_callback			
	IRQ Enable	Enabled			
	IRQ Callback	ob1203_irq_callback	A user IRQ can be provided.		—

2. On the [Pins] tabbed page, select "Interrupt:IRQ" → "IRQ" in [Pin Selection], and set the IRQ of the port connected by a jumper in [Pin Configuration].

8						— 🗆	×
*[OB1203_RE01_256KB] FSP Configuration ×							- [
Pin Configuration						Generate Project	Conten
Select Pin Configuration	🖬 Export to CSV file 📧 Configure	Pin Driver Warnings	;				
RE01-256KB-EK.pincfg V Manage configu	Generate data:	_bsp_pin_cfg					
Pin Selection	🗉 🗉 🖻 🛱 Pin Configuration					🕄 Cycle Pir	n Group
Type filter text Ports	Name Pin Group Selection	Value Mixed	Lock	Link			
> 🛩 P0	Operation Mode	Custom					
> P1	✓ Input/Output			<_>			
> 🗸 P2	IRQ0	None	(1) (1)	\Rightarrow			
> P3	IRQ1	None		\Rightarrow			
> 🛩 P4	IRQ2	None	a di seconda di second	\Rightarrow			
> P5	IRQ3	None		→			
> P6	IRQ4	None	din .				
> P7	IRQ5	None	- alter				
> P8	IRQ6	None		\Rightarrow			
> ✓ Other Pins	IRQ7	None	0	\Rightarrow			
✓ ✓ Peripherals	IRQ8	None					
> Analog:ADC	IRQ9	P409	۵°	4			
> CLKOUT:CLKOUT	NMI	None	- C	\Rightarrow			
 Connectivity:IIC 							
✓ IIC0							
IIC1							
> Connectivity:QSPI							
> Connectivity:SCI							
> Connectivity:SPI							
> Debug:JTAG/SWD							
> HMI:MIP							
✓ ✓ Interrupt:IRQ							
✓ IRQ	Module name: IRQ						
> Interrupt:KR	Usage: To use	IRQ function with o	utput o	r peripheral modes, ch	hange directly in port dialog		
> 🗸 System:Power, System							
> TRG:CAC							
> Timers:AGT	~						
当子機能 端子番号							
Immary BSP Clocks Pins Interrupts Event Links							



3. On the [Interrupts] tabbed page, select the ICU from [New User Event] in [User Events] and select the IRQ you set on the [Pins] tabbed page.

8			– 🗆 X		
*[OB1203_RE01_256KB] FSP Configuration ×		- 0		
Interrupts Config	uration	G	o ienerate Project Content		
User Events		€ New U	er Event > R Remove ADC	>	
Event		ISR	AGT	5	
			AGTW	\$	
			CAC	>	
			CCC	>	
			CGC	>	
			DIV	>	
			DMAC	>	
			DOC	>	
			DTC	>	
			ELC	>	
			FCU	>	
			GDT	>	
			GPT	>	
			ICU	>	ICU IRQ0 (External pin interrupt 0)
Allocations			IIC	>	ICU IRQ1 (External pin interrupt 1)
Interrupt	Event	ISR	INTEGRATE	>	ICU IRQ2 (External pin interrupt 2)
0	IICO RXI (Receive data full)	R_DRIVER_INITIAL_CALLBACK	IOPORT	>	ICU IRQ3 (External pin interrupt 3)
1	IIC0 TXI (fransmit data empty)	R_DRIVER_INITIAL_CALLBACK	IWDT	>	ICU IRQ4 (External pin interrupt 4)
2	IIC0 TEI (Transmit end)	R_DRIVER_INITIAL_CALLBACK	KEY	>	ICU IRQ5 (External pin interrupt 5)
3	IICO EEI (Transfer error)	R_DRIVER_INITIAL_CALLBACK	LONG	>	ICU IRQ6 (External pin interrupt 6)
			LPM	>	ICU IRQ7 (External pin interrupt 7)
			LVD	>	ICU SNOOZE CANCEL (Canceling from Snooze mode)
			MLCD	>	ICU IRQ8 (External pin interrupt 8)
			OPS	>	ICU IRQ9 (External pin interrupt 9)
			POEG	>	
			PROC	>	
			QSPI	>	
			RDRDY	>	
			ROMOK	>	
			RTC	>	
Summary BSP Clocks Pir	ns Interrupts Event Links Stacks Components		SCI	>	
			SOL	>	
			SPI	>	
			TEST	>	
			TMR	>	
			WDT	>	
			WRRDY	>	
			WUPT	>	

4. In the "Enter the name of ISR for the new user event:" dialog box, add " g_ob1203_sensor0_irq_callback " (naming is "module name"_irq_callback) to set the CMSIS interrupt.

	×
ОК	キャンセル
	OK

5. Press the [General Project Content] button in the SDK Configurator to generate code.

Rewrite the six line of the sample project "RE_OB1203.c" to the IRQ number of the port connected by a jumper.

#define DEMO_EVENT_PORT_IRQ_NUM (SYSTEM_CFG_EVENT_NUMBER_PORT_IRQ9)



5.1.4.1 Light mode settings

Select the rm_ob1203 Light mode stack in the "Stack" tabbed page of the SDK Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description
Module OB120	3 Light mode (rm_ob1203)	
Operation Mode	LS mode	Select the measurement mode. Select
·	CS mode	ambient light sensor (LS) mode or RGB color sensor (CS) mode.
Interrupt Type	Threshold	Select an interrupt type.
	Variation	
Interrupt Source	Clear channel	Select the interrupt source. Red and blue of
	Green channel	RGB channels are only valid in CS mode.
	Red channel (CS mode only)	-
	Blue channel (CS mode only)	-
The Number of	0x02	Sets the number of interrupt events. Values
Similar Consecutive Interrupt Events		range from 0x00 to 0x0F.
Sleep after Interrupt	Enabled	Select the Sleep function after interrupting.
	Disabled	
Gain	1	Select the Gain value.
	3	
	6	
Resolution and	Resolution:13bit. Measurement	Select a combination of the resolution of the
Measurement	Period:200ms	measurement and the measurement period.
Period	Resolution:13bit. Measurement	
	Period:500ms	_
	Resolution:13bit. Measurement	
	Period:1000ms Resolution:13bit. Measurement	-
	Period:2000ms	
	Resolution:16bit. Measurement	
	Period:25ms	_
	Resolution:16bit. Measurement Period:50ms	
	Resolution:16bit. Measurement Period:100ms	
	Resolution:16bit. Measurement	-
	Period:200ms	_
	Resolution:16bit. Measurement	
	Period:500ms Resolution:16bit. Measurement	-
	Period:1000ms	
	Resolution:16bit. Measurement	
	Period:2000ms	
	Resolution:17bit. Measurement	
	Period:50ms Resolution:17bit. Measurement	-
	Period:100ms	
	Resolution:17bit. Measurement	-
	Period:200ms	

Table 5-9 OB1203 Light mode Settings for RE01 256KB / 1500KB Group MCU



	Resolution:17bit. Measurement	
	Period:500ms	_
	Resolution:17bit. Measurement	
	Period:1000ms	-
	Resolution:17bit. Measurement Period:2000ms	
	Resolution:18bit. Measurement	
	Period:100ms	
	Resolution:18bit. Measurement	
	Period:200ms	
	Resolution:18bit. Measurement	
	Period:500ms	
	Resolution:18bit. Measurement	
	Period:1000ms	-
	Resolution:18bit. Measurement	
	Period:2000ms Resolution:19bit, Measurement	-
	Period:200ms	
	Resolution:19bit. Measurement	
	Period:500ms	
	Resolution:19bit. Measurement	
	Period:1000ms	_
	Resolution:19bit. Measurement Period:2000ms	
	Resolution:20bit. Measurement	
	Period:500ms	-
	Resolution:20bit. Measurement	
	Period:1000ms	_
	Resolution:20bit. Measurement Period:2000ms	
Upper Threshold	0x00CCC	Sets the upper threshold. Any value from
	0.00000	0x00000 to 0xFFFFF is valid.
Lower Threshold	0x00000	Sets the lower threshold. Any value from
Variance Threshold	+/- 8 counts	0x00000 to 0xFFFFF is valid. Choose to threshold variance.
	+/- 0 counts +/- 16 counts	
	+/- 32 counts	-
		-
	+/- 64 counts	
	+/- 128 counts	
	+/- 256 counts	
	+/- 512 counts	
	+/- 1024 counts	



5.1.4.3 PPG mode settings

Select the rm_ob1203 PPG mode stack in the "Stack" tabbed page of the SDK Configurator, and the configurable items are shown in the "Properties" tabbed page.

Configurable Item	Value	Description
Module OB120	3 PPG mode (rm_ob1203)	
Operation Mode	PPG1 mode PPG2 mode	Select the measurement mode. PPG1 operates with RED or IR, and PPG2 interleaves in IR and RED order.
Interrupt Type	Data FIFO Almost Full	Select an interrupt type.
Gain	1 1.5 2 4	Select the Gain value.
IR LED Current	0x366	Sets the current value of the IR LED. Any value from 0x000 to 0x3FF is valid.
Red LED Current	0x1B3	Sets the current value of the RED LED. Any value from 0x000 to 0x1FF is valid.
Power Save Mode	Enabled Disabled	Select Power Save Mode on or off.
LED Order	IR LED first, Red LED second RED LED first, IR LED second	Sets the order in which the LEDs are selected.
IR LED Analog Cancellation	Enabled (50% offset of the full-scale value) Disabled	Select Enable and disable analog cancellation for IR LEDs.
Red LED Analog Cancellation	Enabled (50% offset of the full-scale value) Disabled	Select Enable and disable red LED analog cancellation.
Number of Averaged PPG Samples	1 (No averaging)2 consecutives samples are averaged4 consecutives samples are averaged8 consecutives samples are averaged16 consecutives samples are averaged32 consecutives samples are averaged	Select the number of PPG samples to average.
Pulse Width and Measurement Period	Pulse width:130us. Measurement Period:0.3125ms (PPG1 mode only)Pulse width:130us. Measurement Period:0.625msPulse width:130us. Measurement Period:1msPulse width:130us. Measurement Period:1.25msPulse width:130us. Measurement Period:2.5ms	Select the pulse width and measurement period.



	y ,	
	Pulse width:130us. Measurement]
	Period:5ms	
	Pulse width:130us. Measurement]
	Period:10ms	
	Pulse width:130us. Measurement	
	Period:20ms	
	Pulse width:247us. Measurement]
	Period:0.625ms (PPG1 mode only)	
	Pulse width:247us. Measurement	1
	Period:1ms	
	Pulse width:247us. Measurement	1
	Period:1.25ms	
	Pulse width:247us. Measurement	
	Period:2.5ms	
	Pulse width:247us. Measurement	
	Period:5ms	
	Pulse width:247us. Measurement	1
	Period:10ms	
	Pulse width:247us. Measurement	1
	Period:20ms	
	Pulse width:481us. Measurement	-
	Period:1ms (PPG1 mode only)	
	Pulse width:481us. Measurement	-
	Period:1.25ms (PPG1 mode only)	
	Pulse width:481us. Measurement	-
	Period:2.5ms	
	Pulse width:481us. Measurement	-
	Period:5ms	
	Pulse width:481us. Measurement	-
	Period:10ms	
	Pulse width:481us. Measurement	-
	Period:20ms	
	Pulse width:949us. Measurement	-
	Period:2.5ms (PPG1 mode only)	
	Pulse width:949us. Measurement	-
	Period:5ms	
	Pulse width:949us. Measurement	-
	Period:10ms	
	Period. roms Pulse width:949us. Measurement	-
FIFO Rollover	Period:20ms	Choose to enable and disable FIFO
FIFU RUIIOVER	Enabled	overrides.
	Disabled	
FIFO Almost Full	0x0C	Values determines the number of emp
Value		FIFO words when the FIFO almost full
		interrupt is issued.
		Any value from 0x00 to 0x0F is valid.



5.1.4.5 Proximity mode settings

Select the rm_ob1203 Proximity mode stack in the "Stack" tabbed page of the SDK Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description
Module OB1203	3 Proximity mode (rm_ob12	03)
Interrupt Type	Normal	Select an interrupt type.
	Logic	
The Number of Similar Consecutive Interrupt Events	0x02	Sets the number of interrupt events. Any value from 0x00 to 0x0F is valid.
Sleep after Interrupt	Enabled	Selects the sleep feature to be enabled and
	Disabled	disabled after interrupting.
Gain	1	Select the Gain value.
	1.5	
	2	
	4	
LED Current	0x100	Sets the LED current value. Any value from 0x000 to 0x3FF is valid.
LED Order	IR LED first, Red LED second	Sets the order in which the LEDs are
	RED LED first, IR LED second	selected.
LED Analog Cancellation	Enabled (50% offset of the full-scale value)	Choose to enable and disable analog cancellation.
	Disabled	
LED Digital Cancellation	0x100	Set the digital cancellation value. Any value from 0x0000 to 0xFFFF is valid.
Number of LED	1 pulses	Select the number of PULSES of LEDs.
pulses	2 pulses	
	4 pulses	
	8 pulses	
	16 pulses	
	32 pulses	
Pulse Width and Measurement	Pulse width:26us. Measurement Period:3.125ms (except for the	Select the pulse width and measurement period.
Period	number 32 of LED pulses)	r
	Pulse width:26us. Measurement Period:6.25ms	
	Pulse width:26us. Measurement Period:12.5ms	
	Pulse width:26us. Measurement Period:25ms	
	Pulse width:26us. Measurement Period:50ms	
	Pulse width:26us. Measurement Period:100ms	
	Pulse width:26us. Measurement Period:200ms	
	Pulse width:26us. Measurement Period:400ms	

Table 5-11 OB1203 Proximity mode Settings for RE01 256KB / 1500KB Group MCU



	Pulse width:42us. Measurement	
	Period:3.125ms (except for the	
	number 32 of LED pulses)	
	Pulse width:42us. Measurement	
	Period:6.25ms	
	Pulse width:42us. Measurement	
	Period:12.5ms	
	Pulse width:42us. Measurement	
	Period:25ms	
	Pulse width:42us. Measurement	
	Period:50ms	
	Pulse width:42us. Measurement	
	Period:100ms	
	Pulse width:42us. Measurement	
	Period:200ms	
	Pulse width:42us. Measurement	
	Period:400ms	
Moving Average	Enabled	Choose to use moving averages.
	Disabled	
Hysteresis	0x00	Sets the value of hysteresis. Any value from
		0x00 to 0x7F is valid.
Upper Threshold	0x0600	Sets the upper threshold. Any value from
		0x0000 to 0xFFFF is valid.
Lower Threshold	0x0000	Sets the lower threshold. Any value from
		0x0000 to 0xFFFF is valid.



5.1.4.7 Light Proximity mode settings

Select the rm_ob1203 Light Proximity mode stack in the "Stack" tabbed page of the SDK Configurator, and the configurable items are shown in the "Properties" tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description
Module OB1203	3 Light Proximity mode (rm_	ob1203)
General		- /
Device Interrupt	Light mode	Select the interrupt mode
Device interrupt	Proximity mode	Select the interrupt mode.
	Proximity mode	
Light mode		
Operation Mode	LS mode	Select the measurement mode. Select
	CS mode	ambient light sensor (LS) mode or RGB color sensor (CS) mode.
Interrupt Type	Threshold	Select an interrupt type.
	Variation	
Interrupt Source	Clear channel	Select the interrupt source. Red and blue of
·	Green channel	RGB channels are only valid in CS mode.
	Red channel (CS mode only)	
	Blue channel (CS mode only)	-
The Number of	0x02	Cata the number of interrupt events Area
Similar Consecutive	0x02	Sets the number of interrupt events. Any value from 0x00 to 0x0F is valid.
Sleep after Interrupt	Enabled	Select the Sleep function after interrupting.
	Disabled	
Gain	1	Select the Gain value.
	3	
	6	
Resolution and	Resolution:13bit. Measurement	Select a combination of the resolution of the
Measurement	Period:200ms	measurement and the measurement period.
Period	Resolution:13bit. Measurement Period:500ms	
	Resolution:13bit. Measurement Period:1000ms	
	Resolution:13bit. Measurement Period:2000ms	
	Resolution:16bit. Measurement Period:25ms	
	Resolution:16bit. Measurement	
	Period:50ms	_
	Resolution:16bit. Measurement	
	Period:100ms	_
	Resolution:16bit. Measurement Period:200ms	
	Resolution:16bit. Measurement Period:500ms	
	Resolution:16bit. Measurement Period:1000ms	
	Resolution:16bit. Measurement Period:2000ms	

Table 5-12 OB1203 Light Proximity mode Settings for RE01 256KB / 1500KB Group MCU



··· •		e croup ob 1200 Campio Contraro Mandai
	Resolution:17bit. Measurement Period:50ms	
	Resolution:17bit. Measurement Period:100ms	
	Resolution:17bit. Measurement Period:200ms	
	Resolution:17bit. Measurement Period:500ms	_
	Resolution:17bit. Measurement Period:1000ms	
	Resolution:17bit. Measurement Period:2000ms	
	Resolution:18bit. Measurement Period:100ms	
	Resolution:18bit. Measurement Period:200ms	
	Resolution:18bit. Measurement Period:500ms	
	Resolution:18bit. Measurement Period:1000ms	
	Resolution:18bit. Measurement Period:2000ms	-
	Resolution:19bit. Measurement Period:200ms	
	Resolution:19bit. Measurement Period:500ms	
	Resolution:19bit. Measurement Period:1000ms	
	Resolution:19bit. Measurement Period:2000ms	
	Resolution:20bit. Measurement Period:500ms	
	Resolution:20bit. Measurement Period:1000ms	
	Resolution:20bit. Measurement Period:2000ms	
Upper Threshold	0x00CCC	Sets the upper threshold. Any value from 0x00000 to 0xFFFFF is valid.
Lower Threshold	0x00000	Sets the lower threshold. Any value from 0x00000 to 0xFFFFF is valid.
Variance Threshold	+/- 8 counts	Choose to threshold variance.
	+/- 16 counts	
	+/- 32 counts	
	+/- 64 counts	
	+/- 128 counts	
	+/- 256 counts	
	+/- 512 counts	
	+/- 1024 counts	
Proximity mode		
Interrupt Type	Normal	Select an interrupt type.
	Logic	
The Number of	0x02	Sets the number of interrupt events. Any
Similar Consecutive Interrupt Events		value from 0x00 to 0x0F is valid.
Sleep after Interrupt	Enabled	Selects the sleep feature to be enabled and
	Disabled	disabled after interrupting.



Gain	1	Select the Gain value.
	1.5	
	2	
	4	
LED Current	0x100	Sets the LED current value. Any value from 0x000 to 0x3FF is valid.
LED Order	IR LED first, Red LED second	Sets the order in which the LEDs are
	RED LED first, IR LED second	selected.
LED Analog Cancellation	Enabled (50% offset of the full-scale value) Disabled	Choose to enable and disable analog cancellation.
LED Digital	0x100	Set the digital cancellation value. Any value
Cancellation Number of LED	1 pulses	from 0x0000 to 0xFFFF is valid. Select the number of PULSES of LEDs.
pulses	· · ·	
pulooo	2 pulses	-
	4 pulses	
	8 pulses	
	16 pulses	_
	32 pulses	
Pulse Width and Measurement Period	Pulse width:26us. MeasurementPeriod:3.125ms (except for the number 32 of LED pulses)Pulse width:26us. MeasurementPeriod:6.25msPulse width:26us. MeasurementPeriod:12.5msPulse width:26us. MeasurementPeriod:25msPulse width:26us. MeasurementPeriod:50msPulse width:26us. MeasurementPeriod:100msPulse width:26us. MeasurementPeriod:200msPulse width:26us. MeasurementPeriod:200msPulse width:26us. MeasurementPeriod:3.125ms (except for the number 32 of LED pulses)Pulse width:42us. Measurement	Select the pulse width and measurement period.
	Period:6.25ms Pulse width:42us. Measurement Period:12.5ms Pulse width:42us. Measurement Period:25ms Pulse width:42us. Measurement Period:50ms	
	Pulse width:42us. Measurement Period:100ms Pulse width:42us. Measurement Period:200ms Pulse width:42us. Measurement	
Moving Average	Period:400ms Enabled Disabled	Choose to use moving averages.



Hysteresis	0x00	Sets the value of hysteresis. Any value from 0x00 to 0x7F is valid.
Upper Threshold	0x0600	Sets the upper threshold. Any value from 0x0000 to 0xFFFF is valid.
Lower Threshold	0x0000	Sets the lower threshold. Any value from 0x0000 to 0xFFFF is valid.



5.2 Sensor Communication Middleware Settings

5.2.1 RA Family

Select the rm_comms_i2c stack on the [Stack] tabbed page of the FSP Configurator, and the configurable items will be shown on the [Properties] tabbed page.

The following items and values can be specified.

Table 5-13 Communication Middleware Settings for the RA Family MCU

Configurable Item	Value	Description	
Common			
Parameter Checking	Default (BSP) Enabled Disabled	Specify whether to include the processing to check parameters in the code to be generated. When "Disabled" is selected, the generated code does not include the processing to check parameters. When "Enabled" is selected, the generated code includes the processing to check parameters.	
Module g_comm	ns_i2c_device I2C Comm	unication Device on	
rm_comms_i2c			
Name	g_comms_i2c_device0	Specify the name of the module. A module name conforming to the C language standard can be specified.	
Semaphore Timeout	0xFFFFFFFF	For an RTOS project, specify the time of semaphore timeout.	
Slave Address	0x53	Specify the slave address. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Address Mode	7-Bit	Specify the number of slave address bits. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Callback	rm_ob1203_comms_i2c_callback	Specify the name of the user callback function. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Module g_comms_i2c_bus0 I2C Shared Bus on rm_comms_i2c			
Name	g_comms_i2c_bus0	Specify the name of the I2C module.	
Bus Timeout	0xFFFFFFF	Specify the time of I2C bus timeout.	
Semaphore for blocking	Unuse Use	For an RTOS project, enable or disable processing for blocking.	
Recursive Mutex for	Unuse	For an RTOS project, enable or disable	
Bus	Use	recursive operation when blocking is enabled.	



5.2.2 RX Family

Select the r_comms_i2c_rx component on the [Component] tabbed page of the Smart Configurator, and the configurable items will be shown in the [Configure] panel.

Configurable Item	Value	Description
Configurations		
Parameter Checking	System Default Enabled Disabled	Specify whether to include the processing to check parameters in the code to be generated. When "Disabled" is selected, the generated code does not include the processing to check parameters. When "Enabled" is selected, the generated code includes the processing to check parameters.
Number of I2C Shared Buses	Unused 1 2 - 16	Specify the number of I2C bus lines that can be connected.
Number of I2C Devices	Unused 1 2 - 16	Specify the number of I2C devices that can be connected.
Blocking operation supporting with RTOS	Disabled Enabled	For an RTOS project, enable or disable the blocking operation.
Bus lock operation supporting with RTOS	Disabled Enabled	For an RTOS project, enable or disable the bus lock operation.
IIC Driver Type for I2C Shared bus(x) (x = 0 - 15)	RIIC SCI IIC Not selected	Specify the I2C type to be used for the communications bus. Using the RIIC requires r_riic_rx. Using the SCI IIC requires r_sci_iic_rx. If an unused FIT module is deleted, a warning message will appear but this will not affect the operation.
Channel No. for I2C Shared bus(x) (x = 0 - 15)	0	Specify the I2C channel number to be used for the communications bus.
Timeout for the bus lock of the I2C bus for I2C Shared Bus(x) (x = 0 - 15)	0xFFFFFFFF	Specify the time of I2C bus lock timeout for I2C bus x. ($x = 0 - 15$)
I2C Shared Bus No. for I2C Communication Device(x) (x = 0 - 15)	I2C Shared Bus(x) (x = 0 - 15)	Specify the configuration of the I2C bus to be used for the communications bus.
Slave address for communication device(x) (x = 0 - 15)	0x53	Specify the slave address of the device to be connected to the communications bus. When using r_ob1203_rx, specify 0x53.
Slave address mode for communication device(x) (x = 0 - 15)	7 bit address mode	Specify the slave address mode. When using r_ ob1203_rx, specify the 7-bit address mode.
Callback function for Communication device(x) (x = 0 - 15)	comms_i2c_user_callback(x) (x = 0 - 15)	Specify the name of the user callback function. When using r_ ob1203_rx, specify rm_ ob1203_callback(y) (y = 0).

 Table 5-14 Communication Middleware Settings for the RX Family MCU



5.2.3 RL78 Family

Settings can be modified by changing the values of constants defined in the \r_config\r_comms_i2c_rl_config.h file in the project tree of the sample project.

Constant Name	Value	Description
Configurations		
COMMS_I2C_CFG_PARA M_CHECKING_ENABLE	0 1	Specify whether to include the processing to check parameters in the code to be generated. When "0" is specified, the generated code does not include the processing to check parameters. When "1" is specified, the generated code includes the processing to check parameters.
COMMS_I2C_CFG_BUS_N	1	Specify the number of communications
UM_MAX	2	bus lines that can be connected.
	3	
	4	
	5	
COMMS_I2C_CFG_DEVIC	1	Specify the number of I2C devices that
E_NUM_MAX	2	can be connected.
	3	
	4	
	5	
COMMS_I2C_CFG_BUS(x)	COMMS_DRIVER_I2C	Specify the I2C type to be used for the
$DRIVER_TYPE$ (x = 0 - 4)	COMMS_DRIVER_SAU_I2C	communications bus.
$\begin{array}{l} COMMS_I2C_CFG_DEVIC\\ E(x)_BUS_CH\\ (x = 0 - 4) \end{array}$	$g_comms_i2c_bus(x)_extend$ ed_cfg (x = 0 - 4)	Specify the configuration of the I2C bus to be used for the communications bus.
$\begin{array}{l} COMMS_I2C_CFG_DEVIC\\ E(x)_SLAVE_ADDR\\ (x = 0 - 4) \end{array}$	0x53	Specify the slave address of the device to be connected to the communications bus. When using rm_ ob1203, specify 0x53.
$\begin{array}{l} \text{COMMS_I2C_CFG_DEVIC} \\ \text{E(x)_CALLBACK} \\ (\text{x} = 0 - 4) \end{array}$	$comms_i2c_user_callback1(x)$ (x = 0 - 4)	Specify the name of the user callback function. When using rm_ ob1203, specify rm_ ob1203_callback(y) (y = 0).

Table 5-15 Communication Middleware Settings for the RL78 Family MCU



5.2.4 RE01 256KB or 1500KB Group

Select the rm_comms_i2c stack on the [Stacks] tabbed page of the SDK Configurator, and the configurable items will be shown on the [Properties] tabbed page.

Configurable Item	Value	Description	
Common			
Parameter Checking	Default (BSP) Enabled Disabled	Specify whether to include the processing to check parameters in the code to be generated. When "Disabled" is selected, the generated code does not include the processing to check parameters. When "Enabled" is selected, the generated code includes the processing to check parameters.	
•	ns_i2c_device I2C Comm	unication Device on	
rm_comms_i2c			
Name	g_comms_i2c_device0	Specify the name of the module. A module name conforming to the C language standard can be specified.	
Semaphore Timeout	0xFFFFFFFF	For an RTOS project, specify the time of semaphore timeout.	
Slave Address	0x53	Specify the slave address. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Address Mode	7-Bit	Specify the number of slave address bits. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Callback	rm_ob1203_comms_i2c_callback	Specify the name of the user callback function. When rm_ob1203 is used, this value is automatically specified and cannot be modified.	
Module g_comms_i2c_bus0 I2C Shared Bus on rm_comms_i2c			
Name	g_comms_i2c_bus0	Specify the name of the I2C module.	
Bus Timeout	0xFFFFFFF	Specify the time of I2C bus timeout.	
Semaphore for blocking	Unuse Use	For an RTOS project, enable or disable processing for blocking.	
Recursive Mutex for Bus	Unuse Use	For an RTOS project, enable or disable recursive operation when blocking is enabled.	



5.3 I2C Driver Settings

5.3.1 RA Family

Select the r_iic_master or r_sci_i2c stack on the [Stack] tabbed page of the FSP Configurator, and the configurable items will be shown on the [Properties] tabbed page.

Table 5-17 r_iic_master Settings for the RA Family MCL	Table 5-17	r iic mast	er Settings for	the RA Fan	nily MCU
--	------------	------------	-----------------	------------	----------

Configurable Item	Value	Description	
Common	1	·	
Parameter Checking	Default (BSP)	Specify whether to include the processing to	
	Enabled	check parameters in the code to be generated. When "Disabled" is selected, the generated code	
	Disabled	does not include the processing to check	
		parameters.	
		When "Enabled" is selected, the generated code includes the processing to check parameters.	
DTC on	Enabled	Specify whether to use the DTC in transmission	
Transmission and Reception	Disabled	and reception.	
10-bit slave	Enabled	Specify whether to support 10-bit slave	
addressing	Disabled	addresses.	
Module a i2c m	naster0 I2C Master Driv	When using rm_ob1203, select "Disabled".	
Name	g_i2c_master0	Specify the name of the module.	
	-		
Channel	0	Specify the channel number to be used.	
Rate	Standard	Specify the baud rate.	
	Fast-mode	When using rm_ ob1203, select "Standard" or "Fast-mode".	
	Fast-mode plus		
Rise Time (ns)	120	Specify the time for the SCL signal to rise according to the specifications of the target board to be used.	
Fall Time (ns)	120	Specify the time for the SCL signal to fall according to the specifications of the target board to be used.	
Duty Cycle (%)	50	Specify the SCL duty cycle.	
Slave Address	0x00	This item specifies the slave address of the device	
		to be connected but the user does not need to	
		make this setting because rm_comms_i2c overwrites any setting made here.	
Address Mode	7-Bit	This item specifies the salve address mode for the device to be connected but the user does not	
	10-Bit	need to make this setting because rm_comms_i2c	
		overwrites any setting made here.	
Timeout Mode	Short Mode	Specify the time of I2C bus timeout.	
	Long Mode		
Callback	rm_comms_i2c_callback	The name of the user callback function is automatically specified by rm_comms_i2c.	
Interrupt Priority	Priority 0 (highest)	Specify the interrupt priority level of the I2C bus	
Level	Priority 1	driver.	
	Priority 2	1	
	Priority 3	1	



	Priority 4	
	Priority 5	
	Priority 6	
	Priority 7	
	Priority 8	
	Priority 9	
	Priority 10	
	Priority 11	
	Priority 12	
	Priority 13	
	Priority 14	
	Priority 15	
Pins		
SDA	Pxxx	The pin numbers to be used by the driver are
SCL	Рххх	displayed. Use the [Pins] tabbed page to modify the pin configuration.



Table 5-18 r_sci_i2c Settings for the RA Family MCU

Configurable Item	Value	Description
Common	1	
Parameter Checking	Default (BSP)	Specify whether to include the processing to
	Enabled	check parameters in the code to be generated. When "Disabled" is selected, the generated code
	Disabled	does not include the processing to check
		parameters.
		When "Enabled" is selected, the generated code includes the processing to check parameters.
DTC on	Enabled	Specify whether to use the DTC in transmission
Transmission and Reception	Disabled	and reception.
10-bit slave	Enabled	Specify whether to support 10-bit slave
addressing	Disabled	addresses. When using rm_ ob1203, select "Disabled".
Module a i2c0 l	2C Master Driver on r_	
Name	g_i2c0	Specify the name of the module.
Channel	0	For an RTOS project, specify the time of
		semaphore timeout.
Slave Address	0x00	This item specifies the slave address of the device to be connected but the user does not
		need to make this setting because
		rm_comms_i2c overwrites any setting made
Address Mode	7-Bit	here. This item specifies the salve address mode for
	10-bit	the device to be connected but the user does not
		need to make this setting because rm_comms_i2c overwrites any setting made
		here.
Rate	Standard	Specify the baud rate. Select "Standard" or "Fast-mode".
	Fast-mode	Select Standard of Fast-mode.
SDA Output Delay	Fast-mode plus 300	Specify the SDA output delay time
(nano seconds)	500	Specify the SDA output delay time.
Noise filter setting	Use clock signal divided by 1 with noise filter	Specify the noise filter to be used for input signals.
	Use clock signal divided by 2 with noise filter	
	Use clock signal divided by 4 with noise filter	
	Use clock signal divided by 8 with noise filter	
Bit Rate Modulation	Enable	Enable or disable the bit rate modulation
	Disable	function.
Callback	rm_comms_i2c_callback	The name of the user callback function is automatically specified by rm_comms_i2c.
Interrupt Priority	Priority 0 (highest)	Specify the interrupt priority level of the I2C bus
Level	Priority 1	driver.
	Priority 2	-
	Priority 3	
	Priority 4 Priority 5	-
	Priority 6	-
	i nonty o	



	Priority 7	
	Priority 8	
	Priority 9	
	Priority 10	
	Priority 11	
	Priority 12	
	Priority 13	
	Priority 14	
	Priority 15	
RX Interrupt Priority	Priority 0 (highest)	When using the DTC, specify the priority level of
Level [Only used when DTC is enabled]	Priority 1	the reception interrupt.
	Priority 2	
	Priority 3	
	Priority 4	
	Priority 5	
	Priority 6	
	Priority 7	
	Priority 8	
	Priority 9	
	Priority 10	
	Priority 11	
	Priority 12	
	Priority 13	
	Priority 14	-
	Priority 15	
	Disabled	
Pins		
SDA	Рххх	The pin numbers to be used by the driver are displayed.
SCL	Рххх	Use the [Pins] tabbed page to modify the pin configuration.



5.3.2 RX Family

Select the r_riic_rx or r_sci_iic_rx component on the [Component] tabbed page of the Smart Configurator, and the configurable items will be shown in the [Configure] panel.

The following items and values can be specified.

Configurable Item	Value	Description
Configurations	·	
Set parameter	System Default	Specify whether to include the processing to check
checking enable	Not	parameters in the code to be generated.
	Include include the processing to check para When "Include" is selected, the gene	When "Not" is selected, the generated code does not include the processing to check parameters. When "Include" is selected, the generated code includes the processing to check parameters.
MCU supported		
channels for CHx $(x = 0 - 2)$	Supported	When a channel is not to be used, select "Not supported". When "Not supported" is selected, the generated
		code does not include processing for the given channel.
		When "Supported" is selected, the generated code includes processing for the given channel.
CHx RIIC bps(kbps)	400	Specify the bit rate.
(x = 0 - 2)		Set this to a value no greater than 400 when using rm_ob1203.
Digital filter for CHx	Not	Specify the number of stages in the noise filter for the
(x = 0 - 2)	One IIC phi	specified channel.
	Two IIC phi	When "Not" is selected, the noise filter is disabled.
	Three IIC phi	
	Four IIC phi	
Setting port setting processing	Not include port setting Include port setting	Specify whether to include the settings for using port pins as the SCL and SDA pins in the code to be
		generated.
		When "Not include port setting" is selected, the generated code does not include the processing for setting port pins to serve as serial pins.
		When "Include port setting" is selected, the
		generated code includes the processing for setting port pins to serve as serial pins.
Master arbitration lost	Unused	Enable or disable the master loss-in-arbitration
detection function for	Used	detection function for the specified channel.
CHx		When using multiple masters, select "Used"
(x = 0 - 2)		(enabled). When "Unused" is selected, master loss-in-arbitration
		detection is disabled.
		When "Used" is selected, master loss-in-arbitration detection is enabled.
Address y format for	Not	Specify whether to support 7-bit addressing or 10-bit
CHx	7 bit address format	addressing for the slave address of the specified
(x = 0 - 2, y = 0 - 2)	10 bit address format	RIIC.
· · · · · · · · · · · · · · · · · · ·		When using rm_ob1203, select "7 bit address format".

Table 5-19 r_riic_rx Settings for the RX Family MCU



	0x0025	This item specifies the slove address for the specified
Slave Address y for CHx	0x0025	This item specifies the slave address for the specified channel but the user does not need to make this
(x = 0 - 2, y = 0 - 2)		setting because rm_comms_i2c overwrites any
		setting made here.
General call address	Unused	Enable or disable the use of the general call address
for CHx	Used	with the specified channel.
		When "Unused" is selected, the use of the general
		call address is disabled. When "Used" is selected, the use of the general call
		address is enabled.
CHx RXI INT Priority	Level 1	Specify the priority level of the reception data full
Level	Level 2	interrupt (RXI) for the specified channel.
(x = 0 - 2)	Level 3	Specify a level from 1 to 15.
	Level 4	
	Level 5	
	Level 6	
	Level 7	
	Level 8	
	Level 9	
	Level 10	
	Level 11	
	Level 12	
	Level 13	
	Level 14	
	Level 15 (highest)	
CHx RXI INT Priority	Level 1	Specify the priority level of the transmission data
Level	Level 2	empty interrupt (TXI) for the specified channel.
(x = 0 - 2)	Level 3	Specify a level from 1 to 15.
	Level 4	
	Level 5	
	Level 6	
	Level 7	
	Level 8	
	Level 9	
	Level 10	
	Level 11	
	Level 12	
	Level 13	
	Level 14	
	Level 15 (highest)	Chapter the priority level of the communication error
CHx EEI INT Priority Level	Level 2	Specify the priority level of the communication error or event generation interrupt (EEI) for the specified
(x = 0 - 2)	Level 3	channel.
,,	Level 4	Specify a level from 1 to 15.
	Level 5	
	Level 6	
	Level 7	
	Level 8	
	Level 9	
	Level 10	
	Level 11	
L		<u> </u>



[Level 12	
	Level 13	
	Level 14	
	Level 15 (highest)	
CHx TEI INT Priority	Level 1	Specify the priority level of the transmission end
Level	Level 2	interrupt (TEI) for the specified channel.
(x = 0 - 2)	Level 3	Specify a level from 1 to 15.
	Level 4	
	Level 5	
	Level 6	
	Level 7	
	Level 8	
	Level 9	
	Level 10	
	Level 11	
	Level 12	
	Level 13 Level 14	
Timeout function for	Level 15 (highest)	Eachte an diachte the time and data time for stice for
CHx	Unused	Enable or disable the timeout detection function for the specified channel.
(x = 0 - 2)	Used	When "Unused" is selected, timeout detection is
(x = 0 Z)		disabled.
		When "Used" is selected, timeout detection is
		enabled.
Timeout detection time	Long mode	Specify the time for timeout detection for the
for CHx	Short mode	specified channel.
(x = 0 - 2)		
Count up during low	Unused	Enable or disable incrementing of the internal counter
period of timeout	Used	for detecting a timeout while the SCL signal is at the
detection for CHx $(x = 0, -2)$		low level when the timeout detection function is enabled for the specified channel.
(x = 0 - 2)		When "Unused" is selected, incrementing of the
		counter while the SCL signal is at the low level is
		disabled.
		When "Used" is selected, incrementing of the counter
		while the SCL signal is at the low level is enabled.
Count up during high	Unused	Enable or disable incrementing of the internal counter
period of timeout	Used	for detecting a timeout while the SCL signal is at the
detection for CHx		high level when the timeout detection function is
(x = 0 - 2)		enabled for the specified channel. When "Unused" is selected, incrementing of the
		counter while the SCL signal is at the high level is
		disabled.
		When "Used" is selected, incrementing of the counter
		while the SCL signal is at the high level is enabled.
Set Counter of	1000	The value of the timeout counter (the counter for bus
checking bus busy		checking) to be used in the processing of checking
		the bus busy state by API functions can be specified
		by software.
D		
Resources SDAx Pins	Unchecked	Specify the pins to be used.



SCLx Pins	Unchecked	Select the checkboxes for the desired pins.

Table 5-20 r_sci_iic_rx Settings for the RX Family MCU

Configurable Item	Value	Description
Configurations		
Set parameter checking enable	System Default Not Include	Specify whether to include the processing to check parameters in the code to be generated. When "Not" is selected, the generated code does not include the processing to check parameters. When "Include" is selected, the generated code includes the processing to check parameters.
MCU supported channels for CHx (x = 0 - 12)	Not supported Supported	Specify whether to use channel x. When "Not supported" is selected, the generated code does not include processing for the given channel. When "Supported" is selected, the generated code includes processing for the given channel.
SCI IIC bitrate (bps) for CHx (x = 0 - 12)	384000	Specify the bit rate. Set to 384000 (384 Kbits/s) or a smaller value.
Interrupt Priority for	Level 1	Specify the priority level of interrupts triggered by the
CHx	Level 2	detection of a start or stop condition, reception,
(x = 0 - 12)	Level 3	transmit data empty, and transmit end.
	Level 4	Specify a level from 1 to 15.
	Level 5	
	Level 6	
	Level 7	
	Level 8	
	Level 9	
	Level 10	
	Level 11	
	Level 12	
	Level 13	
	Level 14	
	Level 15 (highest)	
Digital noise filter (NFEN bit) for CHx (x = 0 - 12)	Disable Enable	Specify whether to use the noise cancellation function for the SSCL and SSDA input signals. When "Disable" is selected, the noise cancellation function is disabled. When "Enable" is selected, the noise cancellation function is enabled.
Noise Filter Setting	The clock divided by 1	Specify the sampling clock of the digital noise filter.
Register (NFCS bit) for CHx	The clock divided by 2	
(x = 0 - 12)	The clock divided by 4	
· · · ·	The clock divided by 8	
I2C Mode Register 1 (IICDL bit) for CHx (x = 0 - 12)	18	Specify the number of SSDA output delay cycles from the falling edge of the SSCL output. Specify a value from 1 to 31.



Software bus busy check counter	1000	Specify the counter value to be judged to represent the bus busy state. The value of the timeout counter (the counter for bus checking) to be used in the processing of checking the bus busy state by API functions for the simplified I2C can be specified by software.	
Setting port setting processing	Not include port setting Include port setting	Specify whether to include the settings for using port pins as the SSCL and SSDA pins in the code to be generated. When "Not include port setting" is selected, the generated code does not include the processing for setting port pins to serve as serial pins. When "Include port setting" is selected, the generated code includes the processing for setting port pins to serve as serial pins.	
Resources			
SSDAx Pins SSCLx Pins	Unchecked Unchecked	Specify the pins to be used. Select the checkboxes for the desired pins.	



5.3.3 RL78 Family

Select "Serial" from the peripheral functions in the Code Generator, and the configurable items will be shown on the [Peripheral Functions] tabbed page.

The following items and values can be specified.

Configurable Item	Value	Description
SAUx		
Channel		
Channel x	Unused	Specify the communication function of the channel
	UARTxx	to be used.
	CSIxx	When using rm_ob1203, select IICxx.
	IICxx	
IICxx		
Transfer rate	1000000	Specify the bit rate.
		When using rm_ob1203, specify 100000.
Transfer end interrupt	High	Specify the priority level of the transfer end
priority (INTIICxx)	Level1	interrupt.
	Level2	
	Low	
Master transmission end	Checked	Specify whether to use the callback function when master transmission ends.
Master reception end	Checked	Specify whether to use the callback function when master reception ends.
Master error	Checked	Specify whether to use the callback function when a communication error occurs.
IICAx		
Transfer mode		
Transfer mode	Unused	Specify the communication function of the channel
	Single master	to be used.
	Slave	Select "Single master".
Setting	1	
Clock mode setting	fCLK	Specify the clock to drive counting.
	fCLK/2	
Address	16	Specify the local address.
Operation mode	Standard	Specify the operating mode.
setting	Fast mode/Fast mode plus	
Transfer clock (fSCL)	100000	Specify the bit rate. Set to 400000 or a smaller value.
Communication end	High	Specify the priority level of the communication end
interrupt priority	Level1	interrupt.
(INTIICAx)	Level2	
	Low	
Master transmission end	Checked	Specify whether to use the callback function when master transmission ends.
Master reception end	Checked	Specify whether to use the callback function when master reception ends.
Master error	Checked	Specify whether to use the callback function when a communication error occurs.

Table 5-21 Serial Settings for the RL78 Family MCU



Generated stop condition in master transmission/reception end callback function	Checked	Specify whether to generate a stop condition in the callback function. Deselect the checkbox.
--	---------	--

5.3.4 RE01 256KB or 1500KB Group

Select the CMSIS Driver for I2C on the [Stack] tabbed page of the SDK Configurator, and the configurable items will be shown on the [Properties] tabbed page.

The following items and values can be specified.

Table 5-22 CMSIS Driver for I2C Settings for the RE01 256KB or 1500KB Group MCU

Configurable Item	Value	Description		
Common				
Common				
Bus Speed Calculation	Bus Speed Calculation			
Auto Calculation				
Standard Mode				
SCL Up Time(ns)	1000	Set the time for the SCL signal to rise in Standard Mode. A value of or greater than 0 is valid.		
SCL Down Time(ns)	300	Set the time for the SCL signal to fall in Standard Mode. A value of or greater than 0 is valid.		
Fast Mode	·			
SCL Up Time(ns)	300	Set the time for the SCL signal to rise in Fast Mode. A value of or greater than 0 is valid.		
SCL Down Time(ns)	300	Set the time for the SCL signal to fall in Fast Mode. A value of or greater than 0 is valid.		
Manual Calculation				
Standard Mode				
ICBRL Setting	15	Set the ICBRL in Standard Mode. Any value from 0 to 31 is valid.		
ICBRH Setting	12	Set the ICBRH in Standard Mode. Any value from 0 to 31 is valid.		
CKS Setting	3	Set the CKS in Standard Mode. Any value from 0 to 7 is valid.		
Fast Mode				
ICBRL Setting	17	Set the ICBRL in Fast Mode. Any value from 0 to 31 is valid.		
ICBRH Setting	6	Set the ICBRH in Fast Mode. Any value from 0 to 31 is valid.		
CKS Setting	1	Set the CKS in Fast Mode. Any value from 0 to 7 is valid.		
Auto/Manual Calculation	Auto Calculation	Set whether auto or manual calculation is		
	Manual Calculation	applied to the bus speed calculation settings.		



Noise Filter	No digital noise filter circuit used	The noise filter is disabled.
	Filter out noise of up to 1 IIC cycle (Single-stage filter)	Noise removal is applied for no longer than 1 IICφ cycle.
	Filter out noise of up to 2 IIC cycle (2-stage filter)	Noise removal is applied for no longer than 2 IICφ cycles.
	Filter out noise of up to 3 IIC cycle (3-stage filter)	Noise removal is applied for no longer than 3 IICφ cycles.
	Filter out noise of up to 4 IIC cycle (4-stage filter)	Noise removal is applied for no longer than 4 IICφ cycles.
RIICO		
Interrupt Priority		
TXI Priority Level	3	Set the priority level of the TXI interrupt. Any value from 0 to 3 is valid.
TEI Priority Level	3	Set the priority level of the TEI interrupt. Any value from 0 to 3 is valid.
RXI Priority Level	3	Set the priority level of the RXI interrupt. Any value from 0 to 3 is valid.
EEI Priority Level	3	Set the priority level of the EEI interrupt. Any value from 0 to 3 is valid.
RIIC1		
Interrupt Priority		
TXI Priority Level	3	Set the priority level of the TXI interrupt. Any value from 0 to 3 is valid.
TEI Priority Level	3	Set the priority level of the TEI interrupt. Any value from 0 to 3 is valid.
RXI Priority Level	3	Set the priority level of the RXI interrupt. Any value from 0 to 3 is valid.
EEI Priority Level	3	Set the priority level of the EEI interrupt. Any value from 0 to 3 is valid.
API Allocation		· · · ·
ARM_I2C_GetVersion()	Code	Choose whether to run the ARM driver
	RAM Function	functions from the ROM or following deployment to the RAM.
ARM_I2C_GetCapabilities()	Code	deployment to the NAM.
	RAM Function	
ARM_I2C_Initialize()	Code	
	RAM Function	
ARM_I2C_Uninitialize()	Code	
	RAM Function	
ARM_I2C_PowerControl()	Code	
	RAM Function	
ARM_I2C_MasterTransmit()	Code	
	RAM Function	
ARM_I2C_MasterReceive()	Code	
	RAM Function	
ARM_I2C_SlaveTransmit()	Code	
I		1



	RAM Function	
ARM_I2C_SlaveReceive()	Code	
	RAM Function	
ARM_I2C_GetDataCount()	Code	
	RAM Function	
ARM_I2C_Control()	Code	
	RAM Function	
ARM_I2C_GetStatus()	Code	
	RAM Function	
iic_txi_interrupt()	Code	
	RAM Function	
iic_tei_interrupt()	Code	
	RAM Function	
iic_rxi_interrupt()	Code	
	RAM Function	
iic_eei_interrupt()	Code	
	RAM Function	
Module CMSIS Driver for	r I2C on r_i2c_ch0	
Instance Name	g_i2c_0	Specify the name of the module.
Channel	0	Specify the channel number to be used.
Receive data full Interrupt Handler Registration	Enabled	Enable registration of the receive data full interrupt handler. This setting is fixed.
Transmit data empty Interrupt Handler Registration	Enabled	Enable registration of the transmit data empty interrupt handler. This setting is fixed.
Transmit end Interrupt Handler Registration	Enabled	Enable registration of the transmit end interrupt handler. This setting is fixed.
Transfer error Interrupt Handler Registration	Enabled	Enable registration of the transfer error interrupt handler. This setting is fixed.
Pins		
SCL	Pxxx	The pin numbers to be used by the driver are
SDA	Рххх	displayed. Use the [Pins] tabbed page to modify the pin configuration.
	*	



6. Guide to Changing the Target Device

Use the following procedures to change the target device to a new one and run a sample project on the new device.

Before switching to a new device, import the original sample project for the current device to the workspace.

In this chapter, other sensors are used as example figures, but OB1203 works the same way.

6.1 RA Sample Project

Use the following procedures to modify a sample project.

This section describes an example of modifying the sample project "OB1203_RA6M4_NonOS" so that it can be used on the EK-RA2E1 board.

6.1.1 Importing the Sample Project

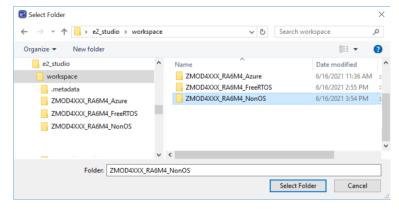
Select [Import] from the menu.

The [Import] window will appear. Select "Rename & Import Existing C/C++ Project into Workspace" in the window and press the [Next] button.

Import	_		×
Select			
Rename and Import and Existing C/C++ Project into the workspace		2	_
Select an import wizard:			
type filter text			
✓ 🧀 General			^
🚇 Archive File			
CMSIS Pack			
CMSIS Pack			
😭 Existing Projects into Workspace			
🚉 File System			
GNUARM-NONE/RZ(DS-5) project conversion to GCC AR	M Emb	edded	
Preferences			
Projects from Folder or Archive			
Rename & Import Existing C/C++ Project into Workspace			
Renesas CCRX project conversion to Renesas GCC RX			
Renesas CS+ Project for CA78K0R/CA78K0			
Renesas CS+ Project for CC-RX and CC-RL			
Renesas GitHub FreeRTOS (with IoT libraries) Project			~
		-	
(?) < <u>B</u> ack <u>N</u> ext > <u>F</u> inish		Canc	el

Press the [Browse] button to open the [Select Folder] window.

Select the folder of the original project for the current device from the list of imported sample projects and press the [Select Folder] button.





Enter the project name, select the original project for the current device, and press the [Finish] button.

🗐 Import	_		\times
Rename & Import Proje Select a directory to search	ect for existing Eclipse projects.		
Project name: ZMOD4XX	(X_RA2E1_NonOS		
Use default location			
Location: C:\U	sers\a5090534\e2_studio\workspace\ZMOD4X	Browse	
Cr	eate Directory for Project		
Choose file system: defa	ult \vee		
Import from:			
Select root directory:	C:\Users\a5090534\e2_studio\workspace \ \sim	Browse	
○ Select archive file:	~	Browse	
Projects:			
ZMOD4XXX_RA6M4_N	onOS (C:\Users\a5090534\e2_studio\workspace	ZMOD4XXX	RA6
<			>
Options	ion output folders		
?	Back Next > Finish	Cancel	



6.1.2 Modifying Settings of the FSP Configurator

Double-click on "Configuratorn.xml" in the project tree to open the FSP Configurator.

Change the settings of "Board" and "Device" on the [BSP] tabbed page.

When selecting a Renesas board, you will only need to modify the "Board" setting.

When selecting a board provided from other companies, change the "Board" setting to "Custom User Board (Any Device)" and then change the "Device" setting to the new device to be used.

Board Support Package Configuration	Generate Project Content
	Restore Defaults
Device Selection	
FSP version: 8.00-rc1+20210426.9fd4431a V Board: Ex-RABMA V Ipa Device: Ex-RABMA V Ipa RTOS EX-RABMA V Ipa RTOS EX-RABMA V Ipa EX-RABMA EX-RABMA Ipa Ipa Ipa EX-RABMA EX-RABMA Ipa Ipa	Board Details Evaluation fit for RAdM4 MCU Group Wat <u>https://www.enas.com/n/w/4ndm1</u> to get kit user's manual, quick start guide, enata, design package, example projects, etc.
RSSK-RAGT1	
Summary BSP Clocks Pins Interrupts Event Links Stacks Cor	nponents

Set up the clocks on the [Clocks] tabbed page.

When "Custom User Board (Any Device)" is selected for "Board", set up the clocks to suit the specifications of the target board to be used.

When a Renesas board is selected for "Board", the clocks are automatically set up.

#[HS300x_RA2E1_NonOS] FSP Configuration 23			- 0
Clocks Configuration			Generate Project Content
			Restore Defaults
XTAL 20MHz		ICLK Div /1	✓ → ICLK 48MHz
LOCO 32768Hz		→ PCLKB Div /2	✓ → PCLKB 24MHz
MOCO 8MHz	Clock Src: HOCO	V PCLKD Div /1	✓ → PCLKD 48MHz
SUBCLK 32768Hz	_		
HOCO 48MHz			
	- CLKOUT Disabled	✓ → CLKOUT Div /1	✓ → CLKOUT 0Hz
Summary BSP Clocks @ Pins Interrupts Event Lin			



Modify the pin configuration on the [Pins] tabbed page.

Modify the settings of the pins for the IIC or SCI to suit the specifications of the target board.

When using a Renesas board, change the selection for "Select Pin Configuration" from "RA6M4 EK" to the target board; appropriate pins will be automatically assigned.

Pic Carliguation Conserve Vision Configuration Conserve Vision Configuration Face face of the Carling of t	德 "(HS300x_RA6M4_NonOS) FSP Configuration 12				- 0
Image: Instance of the second secon	Pin Configuration				Generate Project Content
Pis Schwim Direction Configuration Configuration Type Titre text Image: Configuration Marce Lok Image: Configuration Type Titre text Image: Configuration Marce Lok Image: Configuration Image: Configuration Type Titre text Image: Configuration Marce Lok Image: Configuration Image: Configuration </th <th>Select Pin Configuration</th> <th></th> <th>🔛 Export to CSV file 🛛 E</th> <th>nfigure Pin Driver Warnings</th> <th></th>	Select Pin Configuration		🔛 Export to CSV file 🛛 E	nfigure Pin Driver Warnings	
Type film text Name Wate Urb V # Ards 0 <td0< th=""><th>RARMA EC Manag</th><th>e configurations</th><th>Generate data: g</th><th>osp_pin_cfg</th><th></th></td0<>	RARMA EC Manag	e configurations	Generate data: g	osp_pin_cfg	
PR P P P	Pin Selection	Pin Configuration			😲 Cycle Pin Group
Price Price Price <th></th> <th>Name</th> <th>Value</th> <th>Link</th> <th></th>		Name	Value	Link	
	 ▲ PP ▲ AnalogACM ▲ AnalogACM ▲ AnalogACM ▲ AnalogACM ← ConnectingRD ← ConnectingRD ← ConnectingRD ← ConnectingRD ← PopuECDI ← SystemCCT ← SystemCCT ← TimersAT TimersATC 				
Summary BSP Clocks 😣 Pins Interrupts Event Links 😧 Stacks Components		Stacks Components			

If the desired board is not displayed in the drop-down list for "Select Pin Configuration", click on [Manage Configuration] to open the [Manage Pin Configurations] window and select the desired board in the window.

Manage Pin Configurations		\times
Multiple Pin Configuration Management		
Modify pin configuration list or import/export external file		
RA6M4 EK (Current) R7FA6M4AF3CFB.pincfg	Add	
RA2E1 EK R7FA2E1A92DFM.pincfg	Remove	
KTRAZE IR SZDEWI, pincig	Rename	
	Duplicate	
	Merge to	
	Import	
	Export	
	OK	



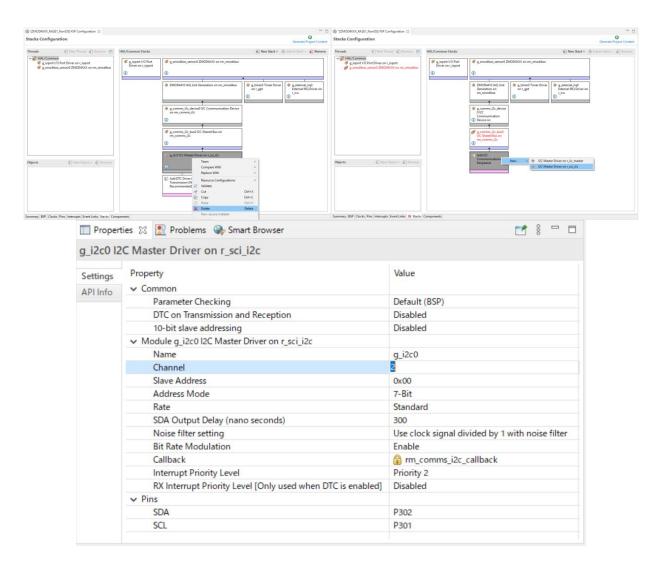
Modify the configuration for individual components on the [Stacks] tabbed page.

Modify the settings of r_iic_master or r_sci_i2c to suit the specifications of the target board.

To use the pins of the IIC, delete the "I2C Master Driver on r_sci_i2c" stack and then add the "I2C Master Driver on r_iic_master" stack.

SCI2 is assigned to PMOD1 and SCI1 is assigned to PMOD2 on the EK-RA2E1 board.

To use PMOD1, set "Channel" to "2". To use PMOD2, set to "1".



Press [Generate Project Content] to generate files.

Build the project.

Select [Debug Configurations] from the menu and modify the debugger settings to suit the specifications of the emulator to be connected to the target board.

6.1.3 Changing the Toolchain Setting

If you want to use a toolchain other than the GCC ARM Embedded toolchain, copy RA_OB1203.c for a non-OS system or ob1203_sensor_thread_entry.c for a FreeRTOS or Azure RTOS system from this project and create a new project.



6.2 RX Sample Project

Use the following procedures to modify a sample project.

This section describes an example of modifying the sample project "OB1203_RX65N_NonOS" so that it can be used on the RSKRX231 board.

6.2.1 Importing the Sample Project

Select [Import] from the menu.

The [Import] window will appear. Select "Rename & Import Existing C/C++ Project into Workspace" in the window and press the [Next] button.

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Select		
Rename and Import and Existing C/C++ Project into the workspace	Ľ	5
Select an import wizard:		
type filter text		
V 🎘 General		~
Archive File		
CMSIS Pack		
GMSIS Pack		
😭 Existing Projects into Workspace		
🚔 File System		
GNUARM-NONE/RZ(DS-5) project conversion to GCC ARM Ember	dded	
Preferences		
Projects from Folder or Archive		
Rename & Import Existing C/C++ Project into Workspace		
🞏 Renesas CCRX project conversion to Renesas GCC RX		
Renesas CS+ Project for CA78K0R/CA78K0		
Renesas CS+ Project for CC-RX and CC-RL		
Renesas GitHub FreeRTOS (with IoT libraries) Project		
✓ (= C/C++		·
	-	
(?) < <u>Back</u> <u>Next ></u> <u>Finish</u>	Cance	4

Press the [Browse] button to open the [Select Folder] window.

Select the folder of the original project for the current device from the list of imported sample projects and press the [Select Folder] button.

Organize V New folder Image: Constraint of the second se	Select Folder → ~ ↑ 📴 « xxxxxxx > e2_stud	io > wor	kspace > 🗸 ひ	Search workspace	: م
workspace Name Date modified metadata 9/16/2021 6:32 PN 220004XXX_RA6M4_Azure 9/16/2021 6:32 PN ZMOD4XXX_RA6M4_FreeRTOS ZMOD4XXX_RA6M4_FreeRTOS 9/16/2021 6:35 PN 220004XXX_RA6M4_FreeRTOS 9/16/2021 6:35 PN ZMOD4XXX_RA6M4_InterceRTOS ZMOD4XXX_RA6M4_InterceRTOS 9/16/2021 6:35 PN 220004XXX_RA6M4_NonOS 9/16/2021 6:35 PN ZMOD410_RL78G14_NonOS ZMOD4410_RL78G14_NonOS 2/16/2021 6:35 PN 220004410_RX65N_Azure 9/16/2021 6:35 PN ZMOD410_RX65N_FreeRTOS ZMOD4410_RX65N_FreeRTOS 9/16/2021 6:35 PN 220004410_RX65N_FreeRTOS 9/16/2021 6:35 PN ZMOD410_RX65N_FreeRTOS ZMOD4510_RL78G14_NonOS 2/16/2021 6:35 PN 220004510_RL78G14_NonOS 9/16/2021 6:35 PN ZMOD4510_RX65N_FreeRTOS ZMOD4510_RL78G14_NonOS 9/16/2021 6:34 PN 220004510_RX65N_FreeRTOS 9/16/2021 6:34 PN ZMOD4510_RX65N_FreeRTOS ZMOD4510_RX65N_FreeRTOS 9/16/2021 6:34 PN 220004510_RX65N_FreeRTOS 9/16/2021 6:35 PN ZMOD4510_RX65N_FreeRTOS ZMOD4510_RX65N_FreeRTOS 9/16/2021 6:35 PN 220004510_RX65N_FreeRTOS 9/16/2021 6:35 PN ZMOD4510_RX65N_NonOS ZMOD4510_RX65N_NonOS	ganize 🔻 New folder			8	. •
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Folder: ZMOD4410_RX65N_NonOS	ZMOD4510_RX65N_NonOS	~ <	:		
	Folder: ZMOD4410_R	X65N_Nor	nOS		
Select Folder Cancel				Colora Coldar	Connel



Enter the project name, select the original project for the current device, and press the [Finish] button.

📴 Import		_		×
Rename & Import Select a directory to	Project earch for existing Eclipse projects.			
Project name: ZMC	D4410_RX231_NonOS			
✓ Use <u>d</u> efault loca	tion			
Location:	C:\Users\xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	/IOD4410	B <u>r</u> owse.	
	Create Directory for Project			
Choose file system:	default 🗠			
Import from:				
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O Select <u>a</u> rchive fil	2	~	B <u>r</u> owse	
< Options	N_NonOS (C:\Users\xxxxxxxxke2_studio\wor	rkspace\ZM	OD4410_R)	×65N_
Keep build contr		nish	Cance	1



6.2.2 Changing the Device

Select the imported project from the project tree and right-click on it to open the context menu. Select [Change Device] from the menu.

占 Pro	ject Exp	olorer 🗙 📃	1	7	000		
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) 📋 :		Open in New Window					
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							2
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		Restore from Local History					
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	1	C/C++ Project Settings		C	trl+/	Alt+F	
		Save build settings report					
		Change Device					
	*	Run C/C++ Code Analysis					
		Team					>
		Compare With					>
	-	•					

Select a desired board or device in the [Change Device] window and press the [Next] button.

Refactoring						×
Change Devic	e					-
Select the new	device for ZMOD4410	_RX231_NonOS				
	R5F565NEDxFB					
Current Board:	RX65NEnvisionKit					
Target Board:	RSKRX231					~
				Download a	additional bo	ards
Target Device:	R5F52318AxFP					
					Unlock Dev	/ices
?		< <u>B</u> ack	<u>N</u> ext >	<u>F</u> inish	Canc	el



If a warning message appears, read it and check if it will create a problem in proceeding with the procedure. Press [Next] to move to the next step.

Refactoring			×
Change Device Review the information provided in the list below. Click 'Nex view the next item or 'Finish'.	t >' to		
Found problems		-	00
(1) This change cannot be undone. Please make sure you ba	ckup this	s project	before
<			>
? < <u>B</u> ack <u>N</u> ext > <u>F</u> inish		Cance	ł

The changes you have made in the settings will be displayed. Press the [Finish] button to apply the changes to the project.

Refactoring		·		×
Change Device				4
The following changes are necessary to perform the refactoring.			-32	
Changes to be performed		Û		7 -
✓ ✓ 叠 Change Device for ZMOD4410_RX231_NonOS				^
🗸 🔽 🛃 Launch Configurations				
ZMOD4410_RX231_NonOS HardwareDebug				
> 🖂 🎦 Build Settings				
🗹 🔂 Project Files				<u> </u>
No preview available				
? < <u>B</u> ack <u>N</u> ext > <u>F</u> inish	1		Cancel	



6.2.3 Modifying Settings of the Smart Configurator

On the project tree, double-click on the .scfg file of the imported project in which the target device has been changed; this will open the Smart Configurator window.

陷 Project Explorer 🗙	Ē	\$₽	7	000		
✓	31_NonOS [Hardwa	reD	ebug	ıl		
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> 🔑 src						
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😹 ZMOD4410_RX						
ZMOD4410_RX	(231_NonOS Hardwa	reDe	bug.	laur	nch	
ZMOD4XXX R	X NonOS.scfq					

Select the [Board] tabbed page to check that the board and device have been changed correctly.

election						Generate Code	🕒 Generate Report
lection							2
RSKRX231 (1.00)			~			
R5F52318A	«FP						
Download n	nore boar	rds					
ard Clocks	System	Components	Pins	Interrunts			
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Set up the clocks on the [Clocks] tabbed page to suit the specifications of the target board to be used.

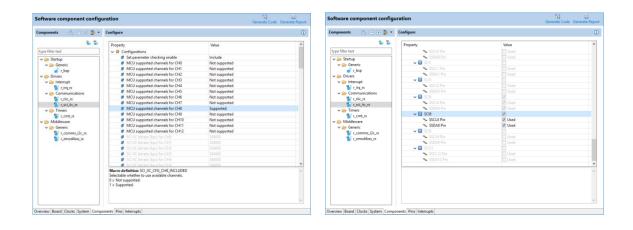
Clocks configuration	Generate Code Generate Report	Clocks configuration	Generate Code Generate Report
102 18 10 (Autor even 19 10 (A	VER else 5000 40 00000 REGLARD Reserve and par 5000 pm	102 88 00 MAX WAR 10 494 10040	UEI even 5/5/6 - 4 0 0946 - 0000 0000 0000 0000
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	- 544		
Overview Roard Clocks System Components Pins Internuts	/	Overview Roard Clock System Components Pinc Internats	



Modify the settings for individual components on the [Components] tabbed page to suit the specifications of the target board.

As SCI8 is assigned to PMOD on the RSK RX231 board, change the setting of "MCU supported channels for CH2" to "Not supported" and "MCU supported channels for CH8" to "Supported" in r_sci_iic_rx.

Select the checkboxes for "SSCL8 Pin" and "SSDA8 Pin" for "SCI8" under "Resources".



In addition, as IRQ3 is assigned to the PMOD interrupt signal pin of the sensor, select the checkbox for "IRQ3 Pin" under "Resources" in r_irq_rx and change the setting of "IRQ number for OB1203 sensor device0" to "IRQ3" in r_ob1203_rx.

Components 🛛 🗠 🔁 🛨 🌩 🔻	Configure	0	Components 🛛 🖄 🖂 🕀 🌩	Configure	(
Communication Communi	Property # Ref for RQ11 # Inservice & Brain (Inservice) Brain (Inservice) # Ref Ref RQ12 # # Ref Ref RQ13 # # Ref Ref RQ13 # # Ref Ref RQ14 # # RQ14 # # RQ14 # # RQ17 # # RQ17 #	Value // Cataland	ype filer tol yw Statep v @ Statep v @ Statep v @ Statep v @ tempt v @	Property Property Configurations Property Property Property Property Property Propert	modelou.cm; Qc, allaci0 fonked modelou.cm; Piu, allaci0 Rong Picely 10



Open the [Pins] tabbed page and check that functions are assigned to the SCI8 and IRQ3 pins on the [Pin function] panel.

Hardware Resource 🛛 🕀 🗎 🛔			ି ହ 🔣 🖥	1 2 2	Hardware Resource $\oplus = \downarrow_Z^a \stackrel{\otimes}{\to}$ Pin Function				😒 🖬 🔚 🔤 🗠		
Type filter text	type filter text (* = any	string, ? = any character)	All	~	Type filter text	type f	filter text (* = any st	ing, ? = any character)	All	~	
Q. Port output enable 2 A Q. Reatine clock A Q. Post times B B. TARE TARE TARE TARE TARE SIG Social SCG SCG S	Enabled Function C (758 FSSB RXD8 SXMS08 SMS08 SMS08 M & SSUA TXD8 C 4	Assignment Versigned Versigned		None None None None IO IO	All All	Enab	IRQ0 IRQ1 IRQ2 2 & IRQ3 IRQ4 IRQ5 IRQ6 IRQ7	Asignment Net asigned Net asigned PlanticotometaPoll#TicCboRod#MAG Net asigned PlanticotometaPoll#TicCboRod#MAG Net asigned Net asigned Net asigned Net asigned Net asigned	Pin Number / Not assigned / Not assigned / Not assigned / Not assigned / Not assigned	None None None None	

As the use of PMOD Type 2A (extended SPI) is specified in the RSK RX231 board information, a warning message will appear when I2C is used, but this does not produce any problems.

Connecting a sensor board requires a board for converting the PMOD Type 2A interface to PMOD Type 6A.

Press the [Generate Code] icon to generate code.

			Generate Code Generate F	Rep
General Information				(
This editor allows you to modify the settings stored in config	uration file (.se	cfg)		
Board				
Allow board and device selection				
			Application under	
locks			development	
Allow clock configuration			← Components	
			Middleware	
Components			Device RTOS	
Allow software component selection and configuration				
			→ Pins	
ins				
llow general pin configuration and pin configuration for sel	lected software	e component		
lick here to get more information on User's Manual, Release		ed software component ation Notes <u>Tool News</u>		
Current Configuration ielected board/device: RSFS2318AxFP (ROM size: 512 Kbytes	e Note Applic	ation Notes Tool News		
Current Configuration ielected board/device: RSFS2318AxFP (ROM size: 512 Kbytes	e Note Applic	ation Notes Tool News Kbytes , Pin count: 100)		
Current Configuration elected board/device: RSFS2318AvFP (ROM size: 512 Kbytes enerated location (PROJECT_LOCC): [src]smc_gen	e Note Applic	ation Notes Tool News Kbytes , Pin count: 100)		
Current Configuration elected board/device: RSF52318AvFP (ROM size: 512 Kbytes Benerated location (PROJECT_LOCC): [src]smc_gen	e Note Applic	ation Notes Tool News Kbytes , Pin count: 100)		
Current Configuration elected board/device: R553218AvFP (ROM size; 512 Kbytes enerated location (PROJECT_LOC)): [srclsmc.gen elected components:	e Note Applic	ation Notes Tool News Kbytes , Pin count: 100)		
Current Configuration Exercise Configuration Exercise Dosard/device: RSF52318AvFP (ROM size 512 Kbytes Exercise Components: Component Component	e Note Applic , RAM size: 64 Version	ation Notes Tool News Kbytes, Pin count: 100) Configuration		
Current Configuration elected board/device: R5F52318AvFP (ROM size 512 Kbytes elected component: Component: © Board Support Packages. (r, 5xp) © CMI driver (r,emt, n)	e Note Applic , RAM size: 64 Version 6.21	Ation Notes Tool News Kbytes , Pin count: 100) Configuration r_bsp(used)	Edt	
Current Configuration elected board/device: P552218ArFP (ROM size: 512 Kbytes ienerated location (PRO/ECT_LOC): ser/samc_gen elected components: Component Board Support Packages. (r_btp) C MT driver (r_emt, n) C MT driver (r_emt, n)	e Note Applic , RAM size: 64 Version 6.21 4.90	kbytes , Pin count: 100) Configuration r_bsp(used) r_cm_rx(used)	Edt	
Current Configuration elected board/device: R5F3218AuFP (ROM size 512 Kbytes innerated location (PROJECT_LOC): <u>inclame_gen</u> elected components: Component <u> </u>	e Note Applic , RAM size: 64 Version 6.21 4.90 1.10	kbytes, Pin count: 100) Configuration r_bsp(used) r_comt_siZe_pri(used)	Edt	
Current Configuration elected board/device: R5F52318AvF9 (ROM size 512 Kbytes enerated location (PROJECT_LOC\): src\smc_gen elected component: © Board Support Packages. (r_btsp) © CMI driver (r_cmt, n) © IIC Communication Diver Interface Middleware (r_cc	e Note Applic , RAM size: 64 Version 6.21 4.90 1.10 3.80	Ation Notes Tool News Kbytes , Pin count: 100) Configuration r_bsp(used) r_comt_n(used) r_icm_n(used)	Edt	
elected board/device: R5F52318ArFP (ROM size 512 Kbytes Senerated location (PROLECT_LOCV): src/smc_gen elected components: Component \$ 8 Board Support Packages: (r, bsp) C CMT driver (r, cmt, n) B IC Communication Driver Interface Middleware (r, co B IIC Driver (r, ing, n) B IIC Math Water (Z) Driver, (r, rii, cm)	e Note Applic , RAM size: 64 Version 6.21 4.90 1.10 3.80 2.49	kbytes, Pin count: 100) Configuration r_bsp(used) r_cmr_truixed) r_ira_n(used) r_ira_n(used)	Edit	
Current Configuration idential board /device: RSF32318A#P (ROM size 512 Kbytes isenseted location (RPOLECT_LOCL): set\ume_gen idected components: Component Baard Support Packages. (r_bsp) CMT driver (r_emt, c) RIC Communication Driver Interface Middleware (r_co RIC Driver (r_gr, c)) RIC Chuki Master (2C Driver, (r_fice, n) Simple IC Driver, (r_scili, c, r)	e Note Applic , RAM size: 64 Version 6.21 4.90 1.10 3.80 2.49 2.49	ation Notes Tool News Kbytes, Pin count: 100) Configuration r_brap(used) r_cmm_xit_a, pin(used) r_mit_a, pin(used) r_mit_a, pin(used) r_sc_it_a, ru(used)	Edit	

Build the project.

Select [Debug Configurations] from the menu and modify the debugger settings to suit the specifications of the emulator to be connected to the target board.

6.2.4 Changing the Toolchain Setting

If you want to use a toolchain other than the CC-RX toolchain, copy RX_OB1203.c for a non-OS system, main.c, ob1203_sensor_thread_entry.c for a FreeRTOS system, or ob1203_sensor_thread_entry.c for an Azure RTOS system.



6.3 RL78 Sample Project

Use the following procedures to modify a sample project created by using the Code Generator.

A sample project created by using the Smart Configurator cannot be modified to change the target device because the target device is fixed as the RL78/G23.

6.3.1 Sample Project Modification Using Code Generator

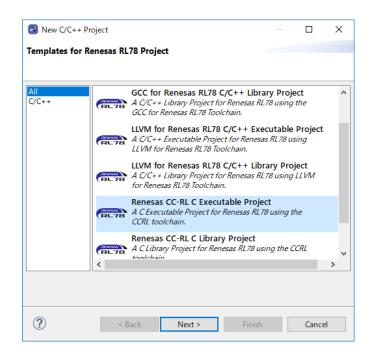
Changing the target device within the RL78 family requires creating a new project.

This section describes an example of creating a new project that can be used on the RSK RL78/G1G board.

6.3.1.1 Creating a New Project

Select [File] \rightarrow [New] \rightarrow [Renesas C/C++ project] \rightarrow [Renesas RL78] from the menu.

Select the template "Renesas CC-RL C Executable Project" and press the [Next] button.





Enter the project name (example: "OB1203_RL78G1G_NonOS") and press the [Next] button.

6		_		\times
New Renesas CC-R	L Executable Project Executable Project			\$
Project name: FS2	012_RL78G1G_NonOS			
Use <u>d</u> efault loc	ation			
Location:	C:\Users\a5090534\e2_studio\workspace\FS2012_RL78G1G_NonOS Create Directory for Project		B <u>r</u> owse,	
Choose file system	default \sim			
Working sets				
Add projec <u>t</u> to	working sets		Ne <u>w</u>	
Working sets:		1	S <u>e</u> lect	
?	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish		Cance	:



Change "Target Device" to a desired device (example: R5F11EFA) and press the [Next] button.

3					_		8	
Device Selection You can filter devices by	regular exp	pression					New Renesas CC-RL Executable Project Select toolchain, device_debug settings	
Search Device								
Device > RL78 - F1E > RL78 - G10 > RL78 - G11 > RL78 - G12	RAM	ROM	Pin	RTOS	Smart Co	Peripher	Toolchain Settings Language:	
 > RL78 - G13 > RL78 - G13A > RL78 - G14 > RL78 - G1A > RL78 - G1C > RL78 - G1E 							Target Board: Custom	figurations Create Hardware Debug Configur E2 Lite (RL78)
 RL78 - G1F RL78 - G1G RL78 - G1G 30pin RL78 - G1G 32pin RL78 - G1G 44pin 							Unlock Devices	Create Debug Configuration RL78 Simulator Create Release Configuration
> R5F11EF8 V R5F11EFA								
R5F11EFA > RL78 - G1H > RL78 - G1K	1 KB	16 KB	44		×	√		

Select the checkbox for "Use Peripheral Code Generator" and press the [Next] button.

8			\times
New Renesas CC-RL Executable Project Select Coding Assistant settings			\$
Use Smart Configurater Image: Statution peripheral code generators automatically generates programs (device drivers) for MCU peripheral formers, serial interfaces, A/D converters, DMA controllers, etc.) based on settings entered via a graphical user in functions are provided as application programming interfaces (APB) and are not limited to initialization of peripheral formers, but a graphical user in functions are provided as application programming interfaces (APB) and are not limited to initialization of peripheral formers, but a graphical user in function are provided as application programming interfaces (APB) and are not limited to initialization of peripheral formers, but and the set of t	nterface	(GUI).	
? < <u>Back</u> <u>Next</u> > <u>Finish</u>		Cance	ł

Press the [Finish] button.

								×
New Renesas CC-RL Exe Summary of project "FS20							Ĵ	2
TOOLCHAIN NAME : TOOLCHAIN VERSION : GENERATION FILES : generate\cstart.asm generate\start.asm generate\start.asm generate\start.asm	Renesas CCRL v1.10.00							< >
?		< <u>B</u> ack	<u>N</u> ext >	E	inish	Ca	ancel	



6.3.1.2 Settings of the Code Generator

Modify the pin assignment on the [Pin assignment] tabbed page for "Peripheral Functions" to suit the specifications of the target board to be used.

	_		_		
Peripheral Fu	n 🔀 🐰 Co	ode Preview 📲 Device Top View 🚆 De	vice List View 🔲 Proper		
				🐻 Generate Code	0
Pin assignment	Clock setting	Block diagram On-chip debug setting	Confirming reset source	Safety functions	
Pin assignment s	setting				
Once the pin ass	ignments have	been fixed it is not possible to change th	em later.		
A new project mu	ust be created	to change the settings.			
PIOP	Function		-		
PIOR register		Port setting			
PIOR11, PIOR10			-		
PIOR13, PIOR12	TRJO0	P30	, 		
			_		
					>

Modify the clock settings on the [Clock setting] tabbed page for "Peripheral Functions" to suit the specifications of the target board.

🚪 Peripheral Fun 🔀 🛛 🛃 Code Previev	v 🚆 Device Top View 🚆 Device List View 👖	
		🐌 Generate Code 🚺
	agram On-chip debug setting Confirming rese	et source Safety functions
Operation mode setting		
High-speed main mode 4.0 (V) ≤ V		
\bigcirc High-speed main mode 3.6 (V) ≤ V		
○ High-speed main mode 2.7 (V) ≤ V		
O Low-speed main mode 2.7 (V) ≤ V	DD ≤ 5.5 (V)	
Main system clock (fMAIN) setting		
 High-speed OCO (fIH) 	◯ High-speed system clock (fMX)	
High-speed OCO clock setting		
Operation	Frequency 48 (fHOCO=48, fIH=24) ~	(MHz)
High-speed system clock setting		
Operation		
	 External clock input (fEX) 	
Frequency	5	(MHz)
Stable time	2^18/fX 🗸 52428.8	(µs)
Low-speed oscillation clock (fIL) setting		
Frequency	15	(kHz)
Interval timer operation clock/Timer RJ o	count source setting	-
Interval timer operation clock/Timer F		(kHz)
CPU and peripheral clock setting		
CPU and peripheral clock (fCLK)	fIH ~ 24000	(kHz)



Select "Used" for "On-chip debug operation setting" on the [On-chip debug setting] tabbed page for "Peripheral Functions".

归 Peripheral Fi	un 🛛 🛃 Co	de Preview 📃	Device Top View 🛛 🖉 De	vice List View 🔲 Proper			
					🕞 Generat	e Code 🧕	
Pin assignment	Clock setting	Block diagram	On-chip debug setting	Confirming reset source	Safety functions		^
-On-chip debug	operation settin	e					
🔘 Unused			Used				
- RRM function :	setting						
🔘 Unused			Used				
-Security ID set	tting						_
🔽 Use Sec	urity ID						
Security ID			0×000000000000000	000000			
-Security ID aut	thentication failu	re setting					
🔿 Do not e	erase flash mem	ory data					

To use the serial array unit, set the channel assigned to PMOD on the target board to "IICxx" on the [Channel] tabbed page in the [Serial Array Unit] or [Serial] setting window.

💯 *Peripheral F	u 🛛 🚽	🔮 Code Previe	ew 📃 Device To	p View り Devi	ce List View	Properties	💯 FIT Configura		
							🐻 Generate Code	0	000
Serial Array Unit									^
Channel UART	TO UART	1 CSI00 I	000						
-Function	1 70.00								
Channel 0	IIC00	~							
Channel 1	Unused	~							
Channel 2	Unused	~							
Channel 3	Unused	\sim							
<								>	



On the tabbed page for IICxx enabled in the serial array unit, set "Transfer rate" to 400000 or 100000, set "Transfer end interrupt priority" to a desired level, and enable all functions under "Callback function setting".

쮎 *Peripheral Fu 🔀 🛒 Code Preview 📓 Device	Top View 📃 Device List View 🔲 P			
		🐻 Generate Code	0	000
<u>Serial Array Unit 0</u>				^
Channel UART0 UART1 CSI00 IC00				
_ Transfer rate setting				
Transfer rate	100000 V (bp	os) (Actual value: 100000)		
-Interrupt setting				
Transfer end interrupt priority (INTIIC00)	Low 🗸			
-Callback function setting				
Master transmission end	Master reception end	🖂 Master error		
٢			>	

To use the serial interface IICA, select "Single master" on the [Transfer mode] tabbed page for the channel assigned to PMOD on the target board in the [Serial Interface IICA] or [Serial] setting window.

🕎 *Peripheral Fu 🛛	3 🧾 Code Preview	🕎 Device Top View	🕎 Device List View	Properties	💯 FIT Configura		
					🐻 Generate Code	0	8
Transfer mode Sett	ing						^
O Unused							
Single master							
◯ Slave							
							Ľ
							۷
<						>	



On the [Setting] tabbed page for the channel set to a single master in the previous step, set "Operation mode setting" to either the combination of "Fast mode" and "400000" or the combination of "Standard" and 100000, set the interrupt priority to a desired level, enable all functions under "Callback function setting", and disable "Callback function enhanced feature setting".

🛃 *Peripheral Fu 🔀 📑 Code Previ	iew 👮 Device Top View 👮 Device List View 🔲 Properties 💯 FIT Configura		
	🐻 Generate Code	. 💿	8
Transfer mode Setting			^
Clock mode setting			
🔾 folk 🚺	fCLK/2		
Local address setting			
Address	16		
Operation mode setting			
 Standard 	◯ Fast mode/Fast mode plus		
Transfer clock (fSCL)	100000 (bps) (Actual value: 99173.554)		
Interrupt setting Communication end interrupt priority Callback function setting			
Master transmission end	Master reception end Master error		
Callback function enhanced feature set			
	turne		
			l
		>	

On the [General setting] tabbed page for a desired channel of the timer array unit or a desired TAU of the timer, select "Interval timer" under "Functions".

	u 🔀 📓 Code Preview	🕎 Device Top View	💹 Device List View	Properties		
					🕞 Generate Code	0
	Channel 0 Channel 1	Channel 2 Channel 3				
Functions	De la constante					
Channel 0	Interval timer		<u> </u>			
Channel 1	Unused		~			
Channel 2	Unused		~			
Channel 3	Unused		~			



On the page for the channel set to an interval timer in the previous step, set "Interval value" to "1 ms", enable timer interrupts, and set the interrupt priority to a desired level.

Peripheral Fu 🛛	Code Preview	🕎 Device Top View	🕎 Device List View	Properties		
					🐻 Generate Code	0
eneral setting Chan	nel 0 Channel 1 Ch	nannel 2 Channel 3				
terval timer setting -						
Interval value (16 b	oits)	1	ms 🗸 (/	Actual value: 1)		
Generates INTT	M00 when counting is	started				
terrupt setting						
🔽 End of timer ch	annel 0 count, generati	e an interrupt (INTTN	100)			
Priority		Low	~			

Press the [Generate Code] button to generate code.



6.3.1.3 Modifying the Generated Code

Open r_cg_sau_user.c, r_cg_iica_user.c, or r_cg_serial_user.c and add the following code.

Definition for including r_comms_i2c_if.h:

Addition of the rm_comms_i2c_bus0_callback() function to the callback function:

Specify the "true" parameter for the transmission and reception end callback functions and the "false" parameter for the error callback function.

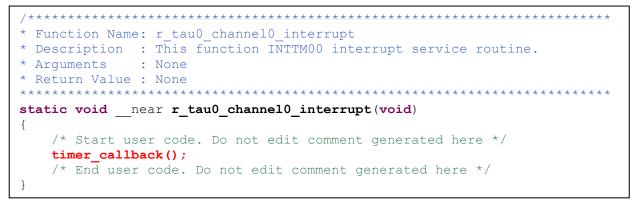
```
* Function Name: r iic00 callback master error
* Description : This function is a callback function when IIC00 master
err
* Arguments : flag -
              status flag
* Return Value : None
static void r iic00 callback master error(MD STATUS flag)
  /* Start user code. Do not edit comment generated here */
  rm comms i2c bus0 callback(false);
  /* End user code. Do not edit comment generated here */
* Function Name: r iic00 callback master receiveend
* Description : This function is a callback function when IIC00 finishes
* Arguments : None
* Return Value : None
                 ****
static void r iic00 callback master receiveend(void)
{
  /* Start user code. Do not edit comment generated here */
  rm comms i2c bus0 callback(true);
  /* End user code. Do not edit comment generated here */
}
* Function Name: r iic00 callback master sendend
* Description : This function is a callback function when IIC00 finishes
* Arguments : None
* Return Value : None
                * * *
static void r_iic00_callback_master_sendend(void)
{
  /* Start user code. Do not edit comment generated here */
  rm comms i2c bus0 callback(true);
  /* End user code. Do not edit comment generated here */
```



Open t_cg_tau_user.c or r_cg_timer_user.c and add the following code.

Declaration of external for the timer_callback() function:

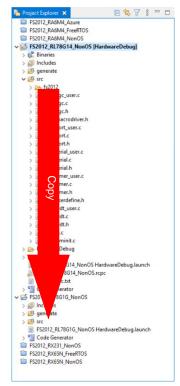
Addition of the call of the timer_callback() function to the timer interrupt callback function:



6.3.1.4 Modifying Sample Source Files

Right-click on the "application" "general" "r_bsp" "r_comms_i2c_rl" "r_config" "r_ob1203" folder in the project tree of the sample project "OB1203_RL78G14_NonOS" and select [Copy] from the context menu.

Then, right-click on the "src" folder in the newly created project and select [Paste] from the context menu to paste the copied files to the folder.





Open r_comms_i2c_rl_config.h in the "r_config" folder and modify the values of the following definitions.

- COMMS_I2C_CFG_BUSx_DRIVER_TYPE
- COMMS_I2C_CFG_BUSx_DRIVER_CH

When channel 0 of the serial array unit is used:

```
/* SPECIFY DRIVER TYPE, CHANNEL NO. AND SLAVE ADDRESS EACH DEVICE */
/* For Bus No.0 */
#define COMMS_I2C_CFG_BUS0_DRIVER_TYPE
Driver */
#define COMMS_I2C_CFG_BUS0_DRIVER_CH
#define COMMS_I2C_CFG_BUS0_SLAVE_ADDR
#define COMMS_I2C_CFG_BUS0_CALLBACK
#define COMMS_I2C_CFG_BUS0_CALLBACK
Callback */
(COMMS_DRIVER_SAU_I2C) /*
```

When channel 0 of the serial interface IICA is used:

```
/* SPECIFY DRIVER TYPE, CHANNEL NO. AND SLAVE ADDRESS EACH DEVICE */
/* For Bus No.0 */
#define COMMS_I2C_CFG_BUS0_DRIVER_TYPE
type */
#define COMMS_I2C_CFG_BUS0_DRIVER_CH
#define COMMS_I2C_CFG_BUS0_SLAVE_ADDR
#define COMMS_I2C_CFG_BUS0_CALLBACK
#define COMMS_I2C_CFG_BUS0_CALLBACK
Callback */
(COMMS_DRIVER_I2C) /* Driver
(0) /* Channel No. */
(0x53) /* Slave address */
(rm_obl203_callback0) /*
```

For the other definitions, refer to section 5, Configuration Settings.

When "serial array unit", "serial interface IICA", or "timer array unit" is used as a peripheral function name in the code generator, modify the sample source code as follows.

 $r_comms_i2c_rl\r_comms_i2c_if.h$

```
Modify "r_cg_serial.h" to "r_cg_sau.h" or "r_cg_iica.h".
```

```
#elif defined(__CCRL__) || defined(__ICCRL78__) || defined(__RL78__)
#include "inc/instances/rm_comms_i2c.h"
#include "r_cg_sau.h"
#endif
```

RL78_OB1203.c

Modify "r_cg_serial.h" to "r_cg_sau.h" or "r_cg_iica.h".

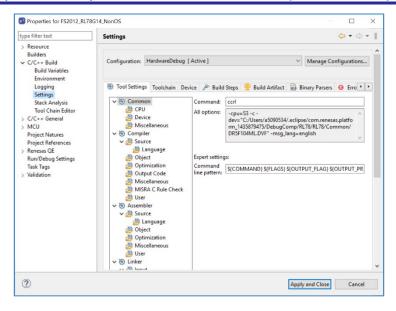
Modify "r_cg_timer.h" to "r_cg_tau.h".

```
#include "r_cg_macrodriver.h"
#include "r_ob1203_if.h"
#include "r_comms_i2c_if.h"
#include "r_cg_sau.h"
#include "r_cg_wdt.h"
#include "r_cg_tau.h"
```

Open the [Properties] window for the project.

Select [C/C++ Build] \rightarrow [Settings] in the [Properties] window to open the [Settings] panel.



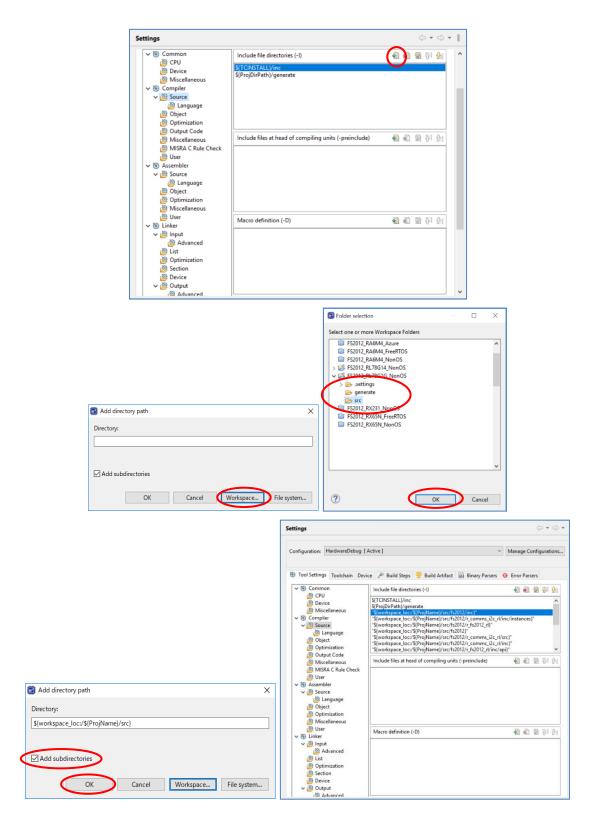




Select [Compiler] \rightarrow [Source] on the [Tool Settings] tabbed page and press the [Add] icon.

Press the [Workspace] button in the [Add directory path] dialog box and a list of projects will appear. Select the "src" folder for the newly created project from the list and press the [OK] button.

Select the checkbox for "Add subdirectories" and press the [OK] button.





Select [Compiler] \rightarrow [Source] \rightarrow [Language] on the [Tool Settings] tabbed page and change the setting of "Language standard of C language" to "C99 language standard".

Press the [Apply and Close] button to close the [Properties] window.

Settings		
Configuration: HardwareDebug [Active]	✓ Manage Configurations
 Tool Settings Toolchain Devi Common CPU Device Miscellaneous Compiler Compiler Source Language Object Optimization Output Code MisRA C Rule Check User 	Allow nested comments (-nest_comment) Character encoding (-character_set)	ion (-refs_without_declaration) 0x7fff bytes ~ UTF-8 ~ C99 language standard ~

Build the project.

Select [Debug Configurations] from the menu and modify the debugger settings to suit the specifications of the emulator to be connected to the target board.

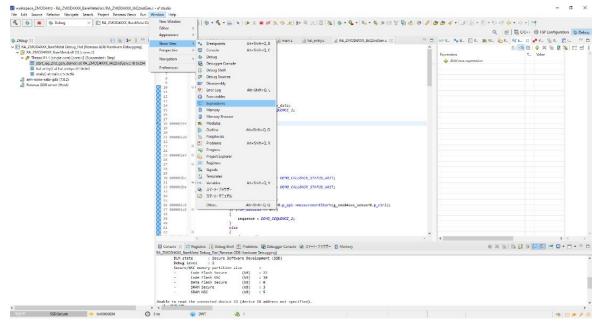


7. Viewing Bio Data

Use the following procedure to view gas data in real time.

In this chapter, ZMOD4XXX is used as example figures, but OB1203 works the same way.

After executing debugging, select [Window] \rightarrow [Show View] \rightarrow [Expressions] to open the [Expressions] tabbed page.



Click on [Add new expression] on the [Expressions] tabbed page and add "gs_ob1203_bio_data".

S workspace_ZMOD4X00_release - ZMOD4410_RA6M4_NonOS/src/RA_ZMOD4410.c - Elle _Edit _Source Refactor _Navigate Segrch _Project Renesas_Views _Bun							- ø ×
S Debug V ZMOD4410_RA6M4_NonOS De	ebuç 🗸 🙆 📑	• 🖩 🕼 🗞 • 🍕 • 🎼 🍓 🗶 🖻 📾 🗱 🎗 🔅 🥂 😫 🗮 🗶 😒 🕼 • 🍕 • 🍕 • 🎼 • 🎼 • 🎼 • 🎼 • 🎼 • 🎼	8 8 9 0	💩 🧶 📌 • 💷 🖄 •	§] • ⊕ © ¢	•••	
						Q 🖬	回 C/C++ ね Debug
12 Debug [2] E 👘 1 😁 0	d startup.c	i main.c i hal_entryc i RA_ZMOD4410.c 12		Mot Vari 🗣 Bre 🗃 Mod	Proj ·· Exp	× .46 5	Peri 🗖 10 🧮 🗖
V ST ZMOD4410 RA6M4 NonOS Debug, Flat [Renesas GDB Hardware Debugging]	1	#include "hal_data.h"	A.		<i>X</i> 1	A P A X	* * * * * *
V T ZMOD4410_RA6M4_NonOS.elf [1] [cores: 0]	5 3	/* 1000: Enable if you want to open ZMOD400X */	-	Expression		Value	as as carico to a
✓ P Thread #1 1 (single core) [core: 0] (Suspended : Step)	2 3	#define G ZMOD4XXX SENSOR0 IRQ ENABLE (1)		v 🥵 gs_iaq_2nd_gen_data	46-		
start_demo() at RA_ZMOD4410.cri97 0x260 hal_entry() at hal_entry.cri6.0x3d0	5			> C rmox		0x200001a8 <	
main() at main.cs 0x3ee	6	<pre>typedef enum e_demo_sequence</pre>		04- log_rcda	float	0	
arm-none-eabi-gdb (7.8.2)	8	DEHD_SEQUENCE_1 = (1),	-	¢d+ iaq	float	0	
Renesas GDB server (Host)	9	DEND_SEQUENCE_2, DEND_SEQUENCE_3.		(4) tvoc		0	
	10	DEND SEQUENCE 4,		64- eco2	float	0	
	1.2	DEMO_SEQUENCE_5,		Add new expression	opar	0	
	13	DEND_SEQUENCE_6, DEND_SEQUENCE_7.		- Puo nen expression			
	15	DENO SEQUENCE 8,					
	1.6	DEHD_SEQUENCE_9,					
	17	} demo_sequence_t;					
	19	<pre>stypedef enum e_demo_callback_status</pre>					
	20 21	{ DEND CALLBACK STATUS WAIT = (0),					
	22	DEHD CALLBACK STATUS SUCCESS,					
	23	DEHD CALLBACK STATUS REPEAT.					
	24	} demo_callback_status_t;					
	2.6	void g comms i2c bus0 quick setup(void);					
	27	<pre>void g_zmod4xxx_sensor0_quick_setup(void);</pre>					
	28 29	<pre>void start_demo(void); void demo err(void);</pre>					
	30						
	31 32	<pre>static volatile demo_callback_status_t gs_i2c_callback_status = DEMO_CALLBACK_STATUS_NAIT; = mif G INCOAXXX SENSORD IRQ ENABLE</pre>					
	33	static volatile demo callback status t gs ing callback status = DEMO CALLBACK STATUS WAIT;					
	34	#endif					
	35 36	<pre>static volatile rm_zmod4xxx_iaq_ist_data_t gs_iaq_ist_gen_data;</pre>					
	37	static volatile rm zmod4xxx_iaq_znd_data_t gs_iaq_znd_gen_data;					
	38	static volatile rm zmod4xxx odor data t gs odor data;					
	39 40	<pre>static volatile rm_zmod4xxx_sulfur_odor_data_t gs_sulfur_odor_data;</pre>					
	41	void zmod4xxx comms i2c callback(rm zmod4xxx callback args t * p args)					
	42		~				
		• Proceeding and the second with the second with the second s	>	٤		>	
	Console 23	💯 Registers 🕕 Debug Shell 💽 Problems 🙀 Debugger Console 🥥 スマート・ブラウザー 📋 Memory			用 2 法 福	at 3 6 8	
		A4_NonOS Debug_Flat [Renesas GDB Hardware Debugging]					
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	ターゲット接続状況						
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Right-click on the added variable and select [Enable Real-time Refresh].

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22 2020-2021 SPANA NH-07C BHURS, 116 [Reveau COI Kerban Debugging] 22 2020-218 SPANA NH-07C BHU [Inc end] v Phone II 1 Lingle can (Jone II) (Supported 1 Span) Exact Span Span Span Span Span Span Span Span	1 1 2 2 3 4 5 6 9 6 11 12 13 13 14 16 15 17 16 17 17 18 18 12 19 17 20 10 21 13 22 23 23 24 24 25 25 23 26 24 27 24 28 23 29 30 20 23 23 24 20 25 21 25 23 30 24 25 25 29 30 30 31 30 32 30 33 30 34 0	<pre>Hinched "sal_deta.b" if "Into: (salid carbonal deta.b") if "Into: (salid carbonal</pre>	<pre>culture to perm PRODUCE memory Reg Heart (1) memory Reg Heart (1) culture to the sequence = (1), culture to the sequence = (1), culture to the sequence sequence = (1), culture to the sequence sequence sequence = (1), culture to the sequence</pre>	jže caliback sta jre_caliback sta gs_lan_ist gs_lan_ist gs_lan_ist gs_lan_ist gs_lan_ist gs_lan_ist souther souther gs_lan_ist gs_l	tus = DDYO_CALLBACK gen_dats; a; a; a; dot_dats; t * P_args) 377- () Memory eccenterecon	status_iout1	^ =	Expression	Setet Al Copy Depresent Copy Depresent Remove A Remove A Remo	••••••••••••••••••••••••••••••••••••	4.4. Spe	ri 10 1 10 1 10 1 10 1 10 1 10 1 10 1 10
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Start debugging, and the temperature and humidity values will be updated in real time.

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ts Debug 🔢 🔲 🛤 🕯 😑 D	E startup.c	2 main.c 2 hal_entryc 2 RA_ZMOD4410.c 23		🖙 Vari 🗣 Bre 📷 Mod	Proj				
ZMOD4410 RA6M4 NonOS Debug Flat [Renesas GDB Hardware Debugging]	1	#include "hal data.h"	^				× % 0 %		
ZMOD4410_RA6M4_NonOS.elf [1] [cores: 0]	2			Expression	Type	Value		1.3 1.1	
Thread #1 1 (single core) [core: 0] (Running)	E 3	/* TODO: Enable if you want to open ZMOD4XXXX */ Wdefine G ZMOD4XXXX SENSORD_IRQ_ENABLE (1)		v gs_iag_2nd_gen_data	volatile m_z_				
am-none-eabi-gdb (7.8.2)	5	and the of power fraction of the fraction of t		> (mox	fioat [13]	0x200001a8 <			
Renesas GDB server (Host)	6	<pre>@typedef enum e_demo_sequence</pre>		60- log_rcda	float	5,18149281			
	7 8	(DEMO SEQUENCE I = (1),	-	por iag	float	1.56795907			
	9	DEWO SEQUENCE 2 = (1), DEWO SEQUENCE 2.		00- tvoc	float	0.356910706			
	10	DEHO_SEQUENCE_3,		po- etch	float	0.189846128			
	11 12	DENO_SEQUENCE_4, DENO_SEQUENCE_5,		00- eco2	float	400.326538			
	12	DEMO_SEQUENCE_5, DEMO_SEQUENCE_6,		d Add new expression					
	1.4	DEMO_SEQUENCE_7,							
	15	DEMO_SEQUENCE_8,							
	16 17	DEMO_SEQUENCE_9, } demo sequence t;							
	18	1. demo"redounce_c2							
	19	<pre>@typedef enum e_demo_callback_status</pre>							
	20 21	(DEMO CALLBACK STATUS WAIT = (0),							
	22	DEMO CALLBACK STATUS SUCCESS,							
	2.3	DEMO_CALLBACK_STATUS_REPEAT,							
	24	} demo_callback_status_t;							
	25 26	void g comms i2c bus0 quick setup(void);							
	20	void g_comms_12c_buse_quick_setup(void); void g_zmod4xxx_sensor@_quick_setup(void);							
	28	void start_demo(void);							
	29	void demo_err(void);							
	30 31	static volatile demo callback status t gs i2c callback status = DEMO CALLBACK STATUS WAIT;							
	32	state volatile deep carback_states c gs_icc_carback_states = bevo_carback_states							
	33	static volatile demo callback status t gs ing callback status = DEMO CALLBACK STATUS WAIT;							
	34	#endif							
	35 36	static volatile rm zmod4xxx iag ist data t gs iag ist gen data;							
	37	static volatile nm zmod4xxx iaq 2nd data t gs iaq 2nd gen data;							
	38	static volatile rm zmod4xxx odor data t gs odor data;							
	39 40	<pre>static volatile rm_zmod4xxx_sulfur_odor_data_t gs_sulfur_odor_data;</pre>							
	41	<pre>@ void zmod4xxx_comms_i2c_callback(rm_zmod4xxx_callback_args_t * p_args)</pre>							
	42	6	~						
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Revision History

		Description	Description			
Rev.	Date	Page	Summary			
1.00	April 27, 2022	-	First Release			
1.01	May 12, 2022	P1,	Added the constraint of sampling rate.			
		P8, P9	Changed table 2-9, 2-11 Operating Environment for the RE01 256KB / 1500KB Group MCU Changed figure 2-6 Hardware Connections for the RE01 1500KB Group			
1.02	March 3, 2023	-	Updated: Environments for RL78			
1.03	March 29, 2023	-	Updated: Environments for RA, RX, RL78, RZ Updated: Guide for Changing the Target Device			



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

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

1. Precaution against Electrostatic Discharge (ESD)

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

2. Processing at power-on

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

3. Input of signal during power-off state

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

4. Handling of unused pins

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

5. Clock signals

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

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

7. Prohibition of access to reserved addresses

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

8. Differences between products

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

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