RL78/G10

Initialization CC-RL

Introduction

This application note describes the basic setting items that are necessary for initializing the RL78/G10.

After the initialization, the sample program discussed in this application note provides on/off control of an LED by switch input.

Target Device

RL78/G10

When applying the sample program covered in this application note to another microcomputer, modify the program according to the specifications for the target microcomputer and conduct an extensive evaluation of the modified program.

Contents

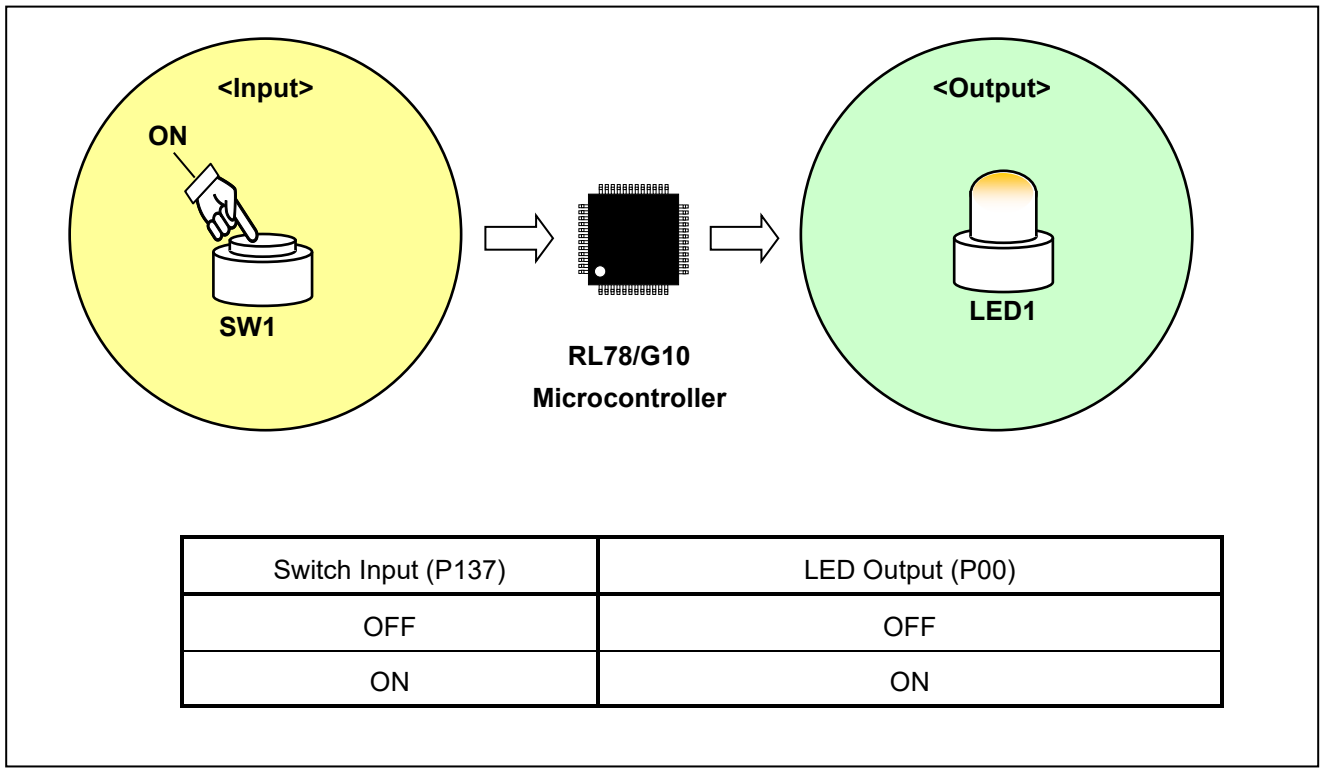
1. Specification

The sample program described in this application note performs basic initialization steps such as the setup of the clock frequency and input/output ports. After the initialization, the program provides on/off control of an LED by switch input during main processing.

Table 1.1 lists the peripheral function to be used and its uses. Figure 1.1 shows the overview of initialization.

Table 1.1 Peripheral Function to be Used and its Uses

Peripheral Function	Use
Port input/output	Switch input (SW1) LED on/off control (LED1)



Switch Input (P137)	LED Output (P00)
OFF	OFF
ON	ON

Figure 1.1 Overview of Initialization

2. Operation Check Conditions

The sample code contained in this application note has been checked under the conditions listed in the table below.

Table 2.1 Operation Check Conditions

Item	Description
Microcontroller used	RL78/G10 (R5F10Y16ASP)
Operating frequency	• High-speed on-chip oscillator (HOCO) clock: 20 MHz • CPU/peripheral hardware clock: 20 MHz
Operating voltage	5.0 V (can run at a voltage range of 2.9 V to 5.5 V.) SPOR detection voltage When reset occurs: V_{DD} < 2.82 V When reset is released: V_{DD} ≥ 2.88 V
Integrated development environment (CS+)	CS+ for CC V3.01.00 from Renesas Electronics Corp.
Assembler (CS+)	CC-RL V1.01.00 from Renesas Electronics Corp.
Integrated development environment (e^2 studio)	e^2 studio V4.0.2.008 from Renesas Electronics Corp.
Assembler (e^2 studio)	CC-RL V1.01.00 from Renesas Electronics Corp.
Integrated development environment (IAR)	IAR Embedded Workbench for IAR Systems.
Assembler (IAR)	IAR Assembler for Renesas RL78 V4.21.2.2420 from IAR Systems.
Board to be used	RL78/G10 target board (QB-R5F10Y16-TB)

3. Description of the Hardware

3.1 Hardware Configuration Example

The example of configuration of the hardware that is used for this application note is shown below.

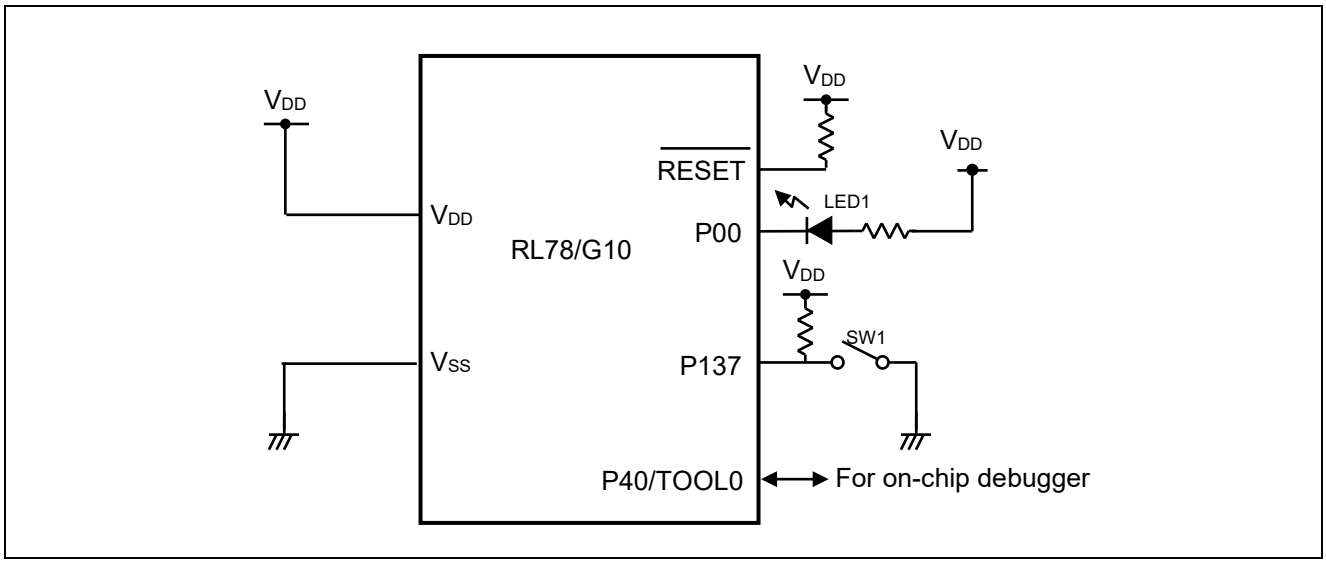


Figure 3.1 Hardware Configuration

Cautions 1 The purpose of this circuit is only to provide the connection outline and the circuit is simplified accordingly. When designing and implementing an actual circuit, provide proper pin treatment and make sure that the hardware's electrical characteristics conditions are met (connect the input-dedicated ports separately to V_{DD} or V_{SS} via a resistor).

2 V_{DD} must be held at not lower than the reset release voltage (V_{SPOR}) that is specified as SPOR.

3.2 List of Pins to be Used

Table 3.1 lists the pins to be used and their functions.

Table 3.1 Pins to be Used and Their Functions

Pin Name	I/O	Description
P00	Output	LED on (LED1) control port
P137	Input	Switch input (SW1) port

4. Description of the Software

4.1 Operation Outline

The sample program described in this application note initializes the CPU (e.g., selecting the CPU clock frequency) and sets up its I/O ports.

After completing the hardware setup, the sample program provides on/off control of an LED (LED1) by switch input (SW1).

(1) CPU initialization [Note]

- Sets up the peripheral I/O redirection function.
- Sets up the I/O ports.
- Sets up the CPU clock.

Note The option bytes are referenced before the initialization of the CPU.

<Setup conditions>

- Sets the reset value because the CPU does not use the peripheral I/O redirection function (PIOR register).
- Makes the following settings for the I/O ports:
  (1) Sets P00 which is to be used for on/off control of an LED (LED1) to 1 and the other unused pins to 0. (port register)
  (2) Sets ports which can be set to output mode to output mode. (port mode register)
- Sets up the CPU clock. [Note]
  (1) Sets the reset value because the high-speed system clock is not to be in use. (clock operation mode control (CMC) register and clock operation status control (CSC) register)
  (2) Selects HOCO (f_{IH}) as the CPU/peripheral hardware clock (f_{CLK}). (system clock control (CKC) register)

Note This setup is only for 16-pin products because 10-pin products do not have the resonator connection pins for the main system clock (X1 and X2) and the external clock input pin (EXCLK). Select only the high-speed on-chip oscillator frequency in 10-pin products.

(2) Executes the main processing

- Performs the LED output control as summarized in Table 4.1 according to the state of the switch input (SW1).

Table 4.1 LED Output

Switch Input (P137)	LED Output (P00)
OFF	OFF
ON	ON

Caution Refer to RL78/G10 User's Manual for notes on device use.

4.2 List of Option Byte Settings

Table 4.2 summarizes the settings of the option bytes.

Table 4.2 Option Byte Settings

Address	Value	Description
000C0H	11101110B	Stops the watchdog timer operation. (Stops counting after the release of the reset state.)
000C1H	11110111B	SPOR detection voltage When reset occurs: V_{DD} < 2.82 V When reset is released: $V_{DD} \geq$ 2.88 V
000C2H	11111001B	HOCO: 20 MHz
000C3H	10000101B	Enables the on-chip debugging function.

4.3 List of Functions (Subroutines)

Table 4.3 lists the functions that are used by this sample program.

Table 4.3 List of Functions (Subroutines)

Function (Subroutine) Name	Outline
RESET_START	Initializes the hardware and calls the main function.
SINIPORT	Sets the I/O ports.
SINICLK	Sets the clock generation circuit.
main	Main function

4.4 Function (Subroutine) Specifications

This section describes the specifications for the functions that are used in the sample code.

[Function Name] RESET_START

Synopsis	Initializes the CPU at reset start.
Header	-
Explanation	Calls the main function after setting the stack pointer and initializing the hardware.
Arguments	None
Return value	None
Remarks	None

[Function Name] SINIPORT

Synopsis	Sets the I/O ports.
Header	-
Explanation	Sets each port of P0 and the unused ports for output (high-level output).
Arguments	None
Return value	None
Remarks	None

[Function Name] SINICLK

Synopsis	Sets the clock generation circuit.
Header	-
Explanation	Initializes the registers related to the clock generation circuit.
Arguments	None
Return value	None
Remarks	None

[Function Name] main

Synopsis	Main function
Header	-
Explanation	Main processing function of the sample code Places the following outputs in P00 according to the value of SW1 (P137). P137 : P00 0 : 0 1 : 1
Arguments	None
Return value	None
Remarks	None

4.5 Flowcharts

Figure 4.1 shows the overall flow of the sample program described in this application note.

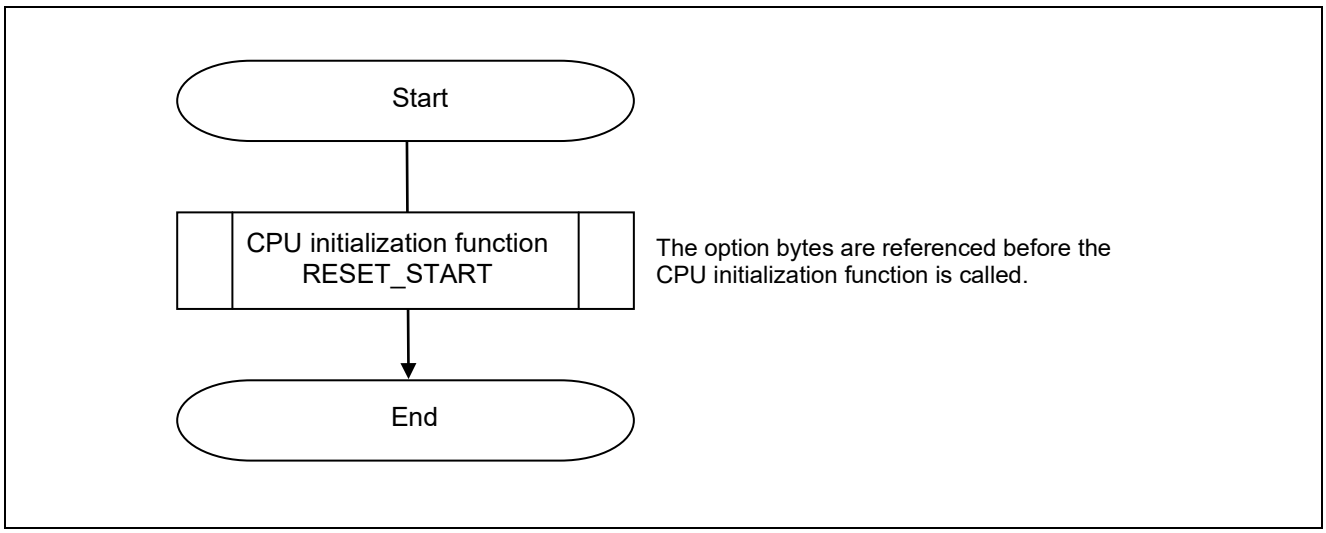


Figure 4.1 Overall Flow

Overview of option byte setting

The option bytes of the RL78/G10 consist of user option bytes (000C0H to 000C2H) and on-chip debug option byte (000C3H).

Upon power application or reset release, an option byte is automatically referenced and a specified function is set. The option bytes are set in the opt.asm file.

User option bytes

- Setting related to watchdog timer (000C0H)
- Setting of SPOR detection level (V_{SPOR}) and $\overline{\text{RESET}}$ pin function (000C1H)
- Setting of the frequency of the high-speed on-chip oscillator (HOCO) (000C2H)
- On-chip debug option byte (000C3H)

The settings for the user option byte are also made in the [User option byte value] of the [Device] category on the [Link Options] tab. The settings on the [Link Options] tab are prioritized over the program setting. As shown below, set [Set user option byte] to [No].

Device	
Set enable/disable on-chip debug by link option	Yes(-OCDBG)
Option byte values for OCD	HEX 85
Set debug monitor area	**Yes(Specify address range)(-DEBUG_MONITOR=<Address range>)**
Range of debug monitor area	**600-7FF**
Set user option byte	**No**
Control allocation to self RAM area	No

Caution For details on the procedure for setting up the CS+ link options, refer to the CS+tutorial.

(1) 000C0H (setting related to watchdog timer)

7	6	5	4	3	2	1	0
1	1	1	WDTON	WDCS2	WDCS1	WDCS0	WDSTBYON
1	**1**	**1**	**0**	**1**	**1**	**1**	**0**

Bit 0

WDSTBYON	Operation control of watchdog timer counter (HALT/STOP mode)
0	**Counter operation stopped in HALT/STOP mode**
1	Counter operation enabled in HALT/STOP mode

Bits 3 to 1

WDCS2 to WDCS0	Overflow time of watchdog timer
000	$(2^6 -1)/f_{IL}$
001	$(2^7 -1)/f_{IL}$
010	$(2^8 -1)/f_{IL}$
011	$(2^9 -1)/f_{IL}$
100	$(2^{11} -1)/f_{IL}$
101	$(2^{13} -1)/f_{IL}$
110	$(2^{14} -1)/f_{IL}$
111	**$(2^{16} -1)/f_{IL}$**

Bit 4

WDTON	Operation control of watchdog timer counter
0	**Counter operation disabled (counting stopped after reset)**
1	Counter operation enabled (counting started after reset)

(2) 000C1H (setting of SPOR detection level (V_{SPOR}) and $\overline{\text{RESET}}$ pin function)

7	6	5	4	3	2	1	0
1	1	1	PORTSELB	SPORS1	SPORS0	1	1
1	**1**	**1**	**1**	**0**	**1**	**1**	**1**

- Setting of SPOR detection voltage

Detection voltage		Option byte setting value	
V_{SPOR} Rising edge	V_{SPOR} Falling edge	SPORS1	SPORS0
4.25 V	4.17 V	0	0
2.88 V	**2.82 V**	**0**	**1**
2.55 V	2.50 V	1	0
2.14 V	2.09 V	1	1

- P125/KR1/$\overline{\text{RESET}}$ pin control

PORTSELB	P125/KR1/$\overline{\text{RESET}}$ pin control
0	**Port function (P125/KR1)**
1	**$\overline{\text{RESET}}$ input (PU125 is set to 1 and internal pull-up resistor can be always connected.)**

(3) 000C2H (setting of the frequency of the high-speed on-chip oscillator)

7	6	5	4	3	2	1	0
1	1	1	1	1	FRQSEL2	FRQSEL1	FRQSEL0
1	**1**	**1**	**1**	**1**	**0**	**0**	**1**

Bits 2 to 0

FRQSEL2	FRQSEL1	FRQSEL0	Frequency of the high-speed on-chip oscillator
0	**0**	**1**	**20 MHz**
0	1	0	10 MHz
0	1	1	5 MHz
1	0	0	2.5 MHz
1	0	1	1.25 MHz
Other than above			Setting prohibited

(4) 000C3H (on-chip debug option bytes)

7	6	5	4	3	2	1	0
OCDENSET	0	0	0	0	1	0	1
1	**0**	**0**	**0**	**0**	**1**	**0**	**1**

Bit 7

OCDENSET	Control of on-chip debug operation
0	Disables on-chip debug operation.
1	**Enables on-chip debug operation.** Note

Note Does not erase data of flash memory in case of failures in authenticating on-chip debug security ID.

4.5.1 CPU Initialization Function

Figure 4.2 shows the flowchart for the CPU initialization function.

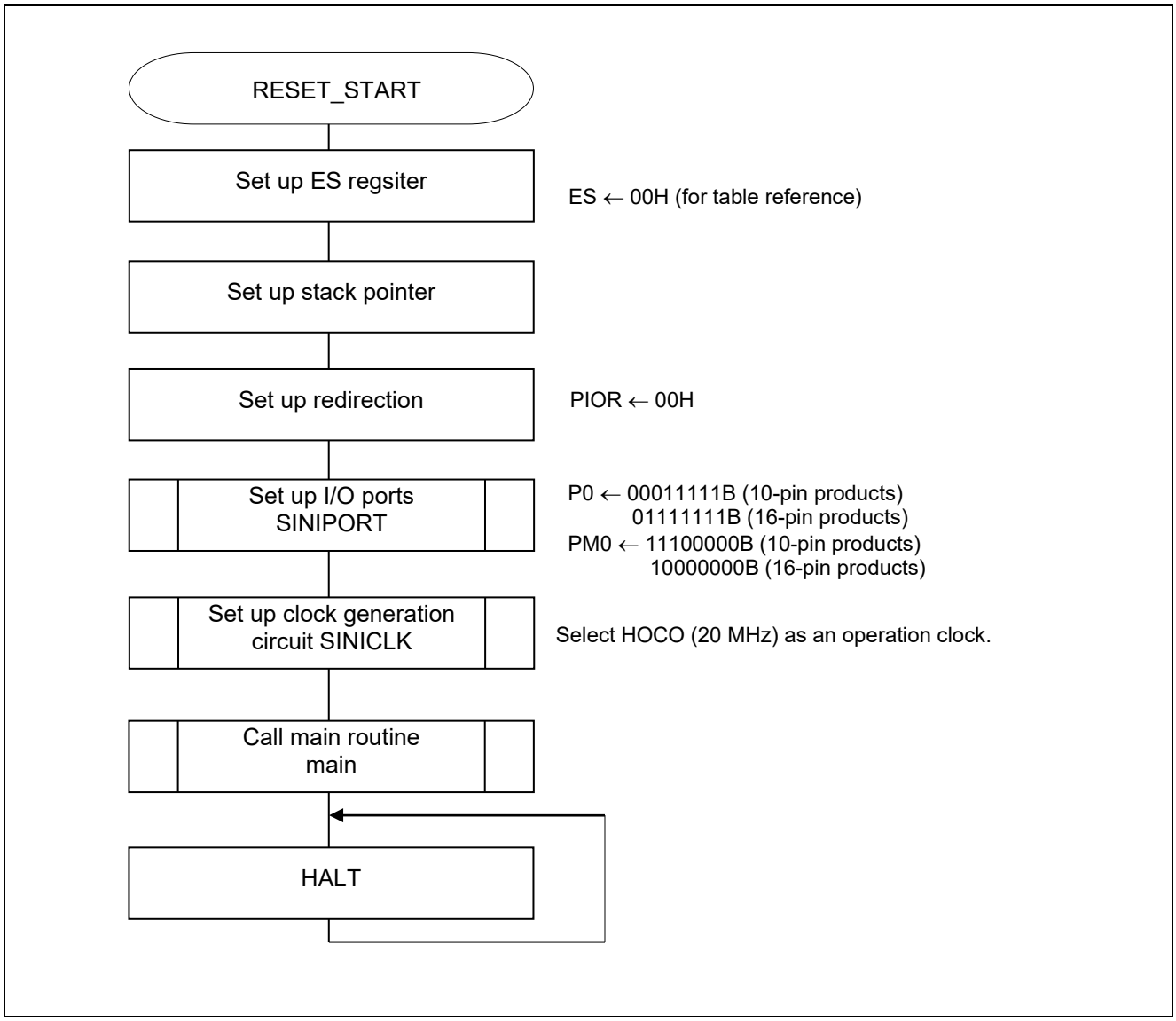


Figure 4.2 CPU Initialization Function

4.5.2 I/O Port Setup

Figure 4.3 shows the flowchart for setting up the I/O ports.

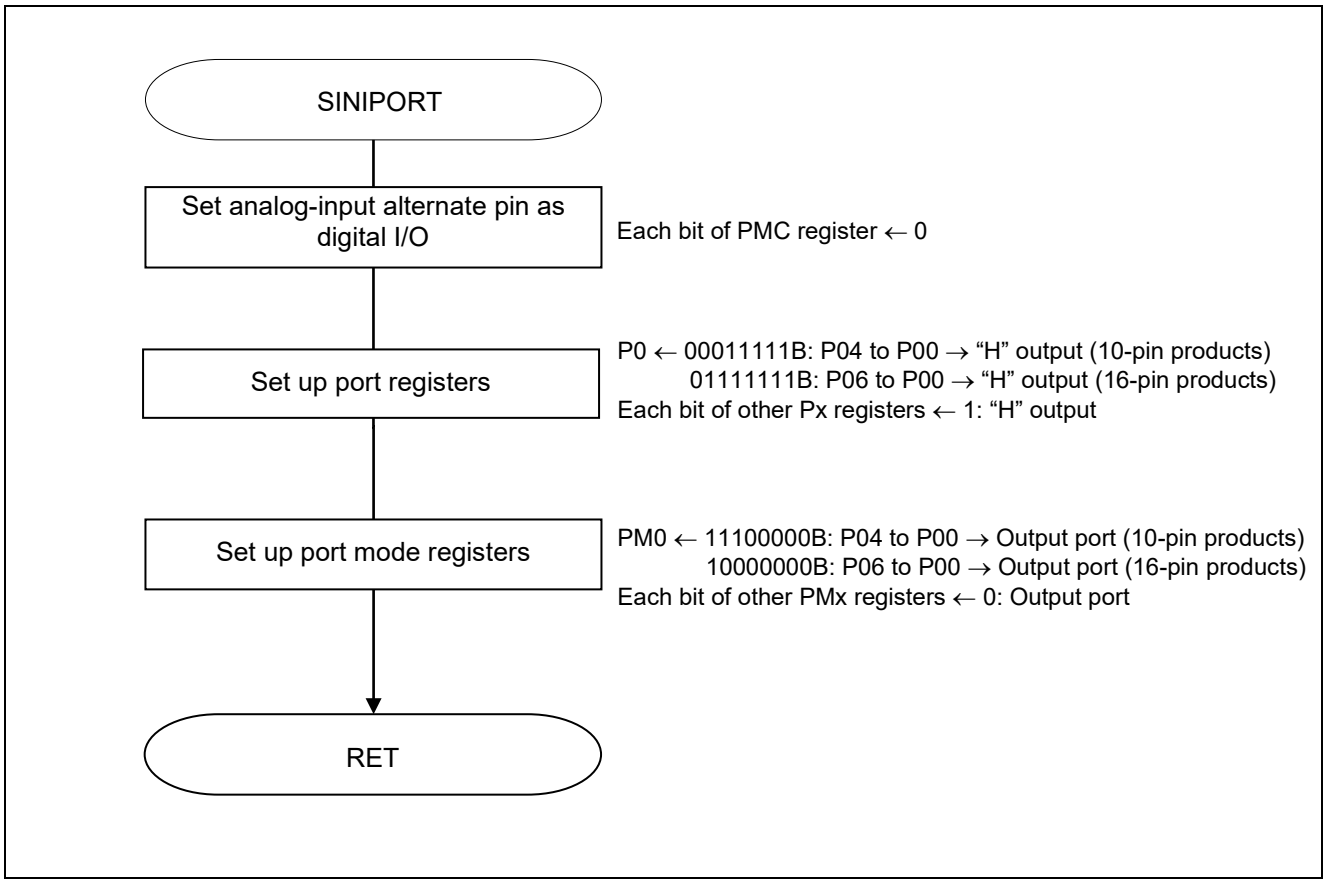


Figure 4.3 I/O Port Setup

Outline of I/O port setup

The RL78/G10 is equipped with digital I/O ports so that it can provide a variety of controls.

The I/O ports serve multiple pin functions in addition to serving as digital I/O ports.

The I/O ports are controlled by the registers listed below. They must be set up during the system initialization routine that is executed when power is first supplied or after the release of the reset state.

Registers that are used to manipulate ports:

- Port mode register (PMxx)
- Port register (Pxx)
- Pull-up resistor option register (PUxx)
- Port output mode register (POMx)
- Port mode control register (PMCxx) Note

Note A register used to place port pins in digital I/O or analog input mode. Since the port pins are configured for analog input when a reset signal occurs, the pins that are to be used for digital I/O must always be set up with this register after the release of the reset state. For the sample program described in this application note, all port pins are configured for digital I/O.

Cautions 1 Refer to RL78/G10 User's Manual: Hardware for the procedure to set up registers to configure ports as alternate-function pins for peripheral functions.
2 Provide proper treatment for unused pins so that their electrical specifications are observed. Connect each of any unused input-only ports to V_{DD} or V_{SS} via a resistor.

The following is an example of manipulating ports that are used in this sample code.

Setting up ports for LEDs

- Port mode register 0 (PM0)
  P00: LED1

Setting up ports for switches

- Port mode register 0 (PM0)

10-pin products

Symbol: PM0

7	6	5	4	3	2	1	0
1	1	1	PM04	PM03	PM02	PM01	PM00
1	**1**	**1**	**0**	**0**	**0**	**0**	**0**

PM0n	PM0n pin I/O mode selection (n = 0 to 4)
0	**Output mode (output buffer on)**
1	**Input mode (output buffer off)**

16-pin products

Symbol: PM0

7	6	5	4	3	2	1	0
1	PM06	PM05	PM04	PM03	PM02	PM01	PM00
1	**0**	**0**	**0**	**0**	**0**	**0**	**0**

PM0n	PM0n pin I/O mode selection (n = 0 to 6)
0	**Output mode (output buffer on)**
1	**Input mode (output buffer off)**

Cautions 1 This sample code configures any unused ports for output to minimize the adverse influence of through current.

2 For details on the procedure for setting up the registers, refer to RL78/G10 User's Manual: Hardware.

4.5.3 Clock Generation Circuit Setup

Figure 4.4 shows the flowchart for clock generation circuit setup. This setup is only for 16-pin products because 10-pin products do not have the resonator connection pins for the main system clock (X1 and X2) and the external clock input pin (EXCLK). Select only the high-speed on-chip oscillator frequency in 10-pin products.

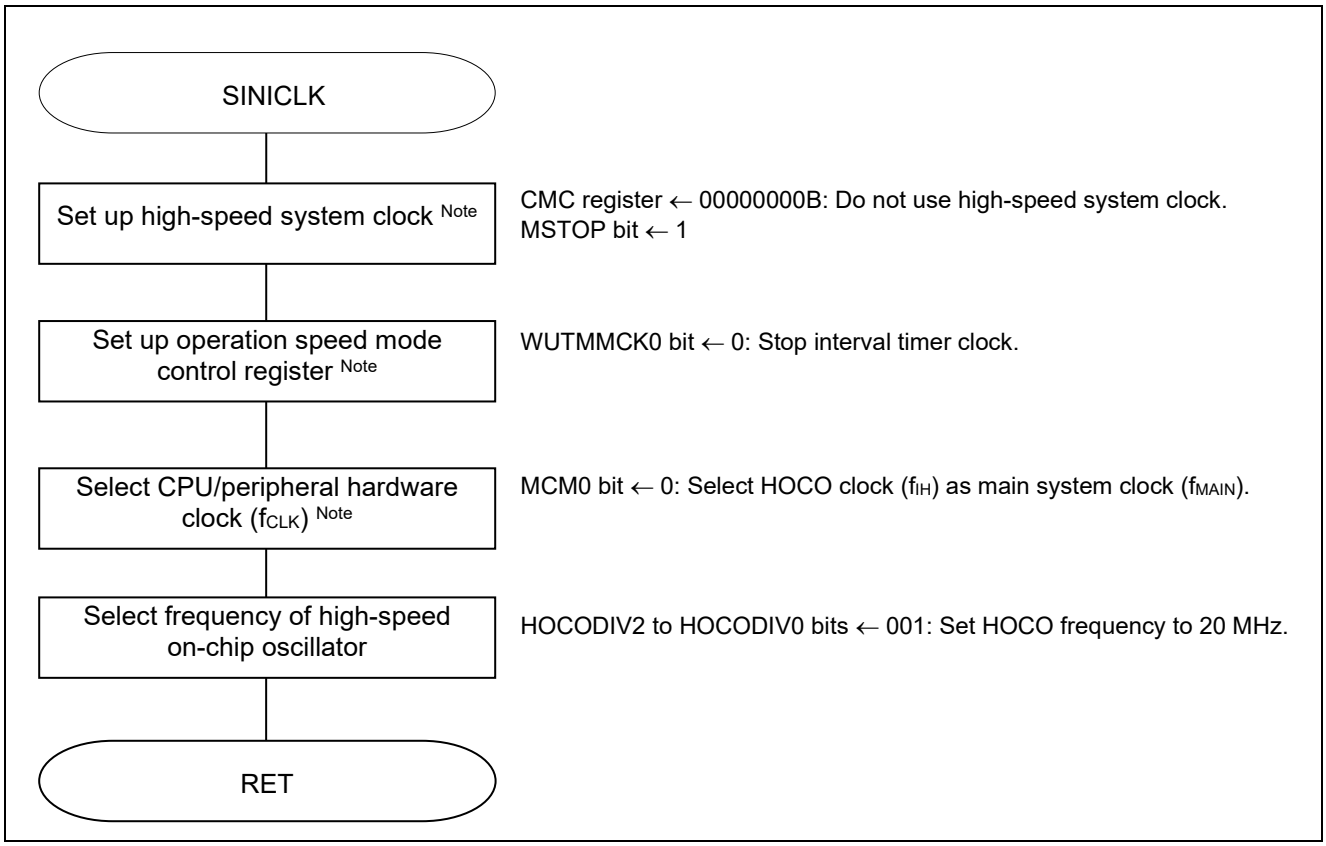


Figure 4.4 Clock Generation Circuit Setup

Overview of clock generation circuit setup

The RL78/G10 allows the user to select the system clock source from the high-performance high-speed on-chip oscillator (HOCO) and main system clock resonator/external clock input Note.

The system clock is controlled by the registers listed below. The CPU clock must be initialized during the system initialization routine that is executed when power is first supplied or after the release of the reset state.

Registers that are used to initialize the clock generation circuit:

- Clock operation mode control register (CMC) Note
- Clock operation status control register (CSC) Note
- Operation speed mode control register (OSMC) Note
- System clock control register (CKC) Note
- High-speed on-chip oscillator frequency selection register (HOCODIV)
- Peripheral enable register 0 (PER0)

Note 16-pin products only.

The following is an example of setting up the clock generation circuit for this sample code.

Setting up the clock operating mode [Note]

- Clock operation mode control register (CMC)
  High-speed system clock pin's operating mode: Input port mode
  X1 clock oscillation frequency control: 1 MHz ≤ f_X ≤ 10 MHz

Symbol: CMC

7	6	5	4	3	2	1	0
EXCLK	OSCSEL	0	0	0	0	0	AMPH
0	**0**	**0**	**0**	0	**0**	**0**	**0**

Bit 0

AMPH	Control of X1 clock oscillation frequency
0	**1 MHz ≤ f_X ≤ 10 MHz**
1	10 MHz < f_X ≤ 20 MHz

Bits 7 and 6

EXCLK	OSCSEL	High-speed system clock pin operation mode	X1/P121 pin	X2/EXCLK/P122 pin
0	**0**	**Input port mode**	**Input port**	
0	1	X1 oscillation mode	Crystal/ceramic resonator connection	
1	0	Input port mode	Input port	
1	1	External clock input mode	Input port	External clock input

Note 16-pin products only.

Caution For details on the procedure for setting up the registers, refer to RL78/G10 User's Manual: Hardware.

Controlling clock operations [Note]

- Clock operation status control register (CSC)
  High-speed system clock operation control: Stop X1 oscillator.
  HOCO clock operation control: HOCO operation

Symbol: CSC

7	6	5	4	3	2	1	0
MSTOP	0	0	0	0	0	0	HIOSTOP
1	0	0	0	0	0	0	**0**

Bit 0

HIOSTOP	High-speed on-chip oscillator clock operation control
0	**High-speed on-chip oscillator clock operating**
1	High-speed on-chip oscillator clock stopped

Bit 7

MSTOP	High-speed system clock operation control		
	X1 oscillation mode	External clock input mode	Input port mode
0	X1 oscillator operating	An external clock from the EXCLK pin enabled	**Input port**
1	**X1 oscillator stopped**	**An external clock from the EXCLK pin disabled**	

Note 16-pin products only.

Caution For details on the procedure for setting up the registers, refer to RL78/G10 User's Manual: Hardware.

Setting up the CPU/peripheral hardware clock (f_{CLK}) Note

- System clock control register (CKC)
  f_{CLK} status: Main system clock
  f_{CLK} selection: HOCO clock (f_{IH})

Symbol: CKC

7	6	5	4	3	2	1	0
0	0	MCS	MCM0	0	0	0	0
0	0	**0**	**0**	0	0	0	0

Bit 4

MCM0	Main system clock (f_{MAIN}) operation control
0	**Selects the high-speed on-chip oscillator clock (f_{IH}) as the main system clock (f_{MAIN})**
1	Selects the high-speed system clock (f_{MX}) as the main system clock (f_{MAIN})

Bit 5

MCS	Status of Main system clock (f_{MAIN})
0	**High-speed on-chip oscillator clock (f_{IH})**
1	High-speed system clock (f_{MX})

Note 16-pin products only.

Caution For details on the procedure for setting up the registers, refer to RL78/G10 User's Manual: Hardware.

Setting use/disuse of peripheral hardware macros

- Peripheral enable register 0 (PER0)
  Hardware input clock control: Stop input clocks.

  Symbol: PER0

7	6	5	4	3	2	1	0
TMKAEN Note	0	ADCEN	IICA0EN Note	0	SAU0EN	0	TAU0EN
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Bit 0

TAU0EN	Control of timer array unit 0 input clock supply
0	**Stops input clock supply.** • **SFR used by timer array unit 0 cannot be written.** • **Timer array unit 0 is in the reset status.**
1	Enables input clock supply. • SFR used by timer array unit 0 can be read and written.

Bit 2

SAU0EN	Control of serial array unit 0 input clock supply
0	**Stops input clock supply.** • **SFR used by serial array unit 0 cannot be written.** • **Serial array unit 0 is in the reset status.**
1	Enables input clock supply. • SFR used by the serial array unit 0 can be read and written.

Bit 4

IICA0EN	Control of serial interface IICA0 input clock supply
0	**Stops input clock supply.** • **SFR used by the serial interface IICA0 cannot be written.** • **The serial interface IICA0 is in the reset status.**
1	Enables input clock supply. • SFR used by the serial interface IICA0 can be read and written.

Bit 5

ADCEN	Control of A/D converter input clock supply
0	**Stops input clock supply.** • **SFR used by the A/D converter cannot be written.** • **The A/D converter is in the reset status.**
1	Enables input clock supply. • SFR used by the A/D converter can be read and written.

Bit 7

TMKAEN	Control of 12-bit interval timer input clock supply
0	**Stops input clock supply.** • **SFR used by the 12-bit interval timer cannot be written.** • **The 12-bit interval timer is in the reset status.**
1	Enables input clock supply. • SFR used by the 12-bit interval timer can be read and written.

Note 16-pin products only.
Caution Power saving and noise reduction are achieved by stopping the supply of clocks to any unused hardware macros.

Controlling the operation speed mode [Note]

- Operation speed mode control register (OSMC)
  Selection of operation clock for interval timer: Stops supply of clock

Symbol: OSMC

7	6	5	4	3	2	1	0
0	0	0	WUTMMCK0	0	0	0	0
0	0	0	**0**	0	0	0	0

Bit 4

WUTMMCK0	Supply of operation clock for interval timer
0	**Stops clock supply**
1	Low-speed on-chip oscillator clock (f_{IL}) supply

Note 16-pin products only.
Caution The OSMC register is designed to reduce the operating current, for low power operation, in STOP mode. For details on its configuration procedure, refer to RL78/G10 User's Manual: Hardware.

Selecting the high-speed on-chip oscillator frequency

- High-speed on-chip oscillator frequency selection register (HOCODIV)
  Change of the high-speed on-chip oscillator clock frequency set with the option byte: 20 MHz

Symbol: HOCODIV

7	6	5	4	3	2	1	0
0	0	0	0	0	HOCODIV2	HOCODIV1	HOCODIV0
0	**0**	**0**	**0**	**0**	**0**	**0**	**1**

Bits 2 to 0

HOCODIV2	HOCODIV1	HOCODIV0	High-speed on-chip oscillator clock frequency selection
0	**0**	**1**	**20 MHz**
0	1	0	10 MHz
0	1	1	5 MHz
1	0	0	2.5 MHz
1	0	1	1.25 MHz
Other than above			Setting prohibited

Caution For details on the procedure for setting up the registers, refer to RL78/G10 User's Manual: Hardware.

4.5.4 Main Processing

Figure 4.5 shows the flowchart for the main processing.

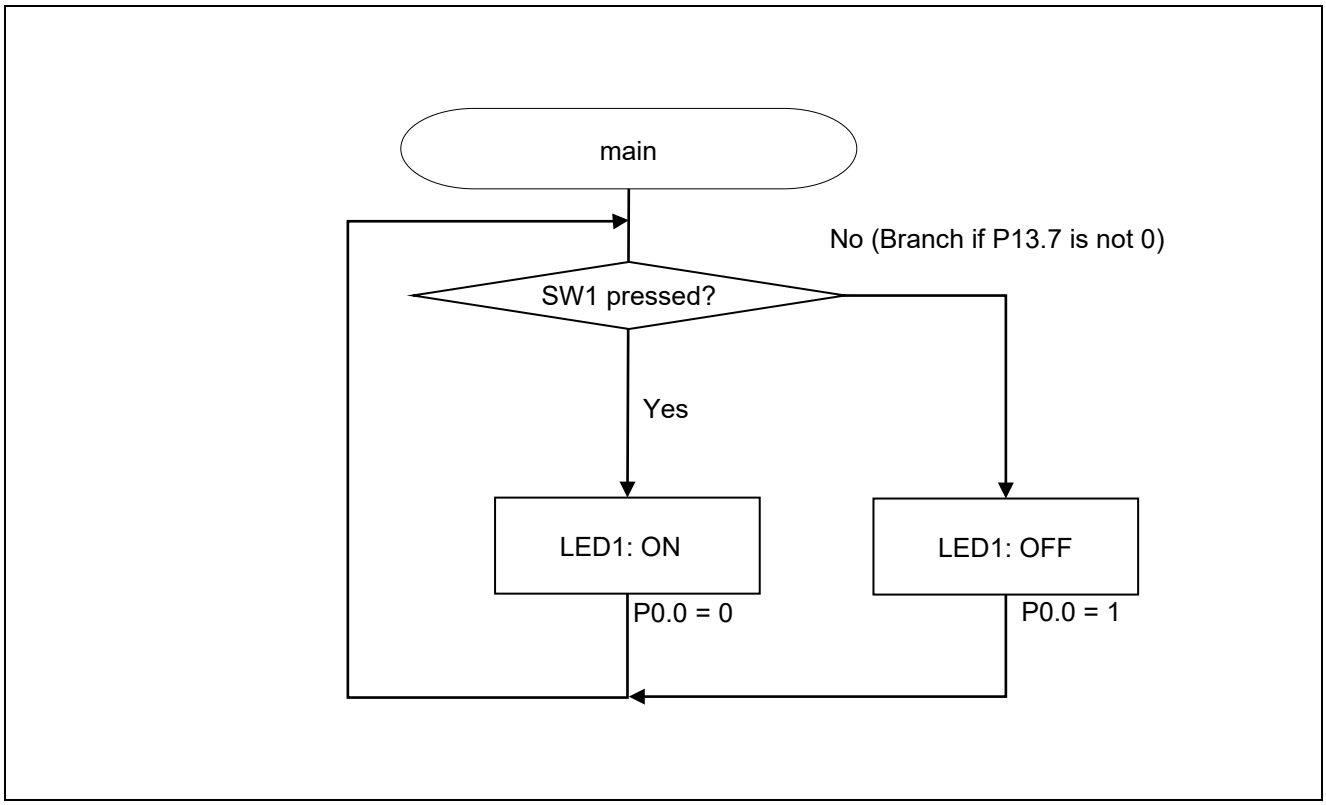


Figure 4.5 Main Processing

5. Selection/Change of Target Product

5.1 Selection of Target Product

The available pins of the RL78/G10 vary with the number of pins in the product. To deal with the difference in the number of the available pins in terms of program, the file including the CPU initialization function (r_init.asm) allows the instruction suitable for each product to be selected by using assembler control instructions from $IF to $ENDIF. The product to be used is defined by using the names below. In 10-pin products, only the R5F10Y16 is defined as “$SET” and the others are defined as “$RESET.”

```
R5F10Y16 SET1     ; 10 pins   ⇦ This is a product to be used.
R5F10Y14 SET0     ; 10 pins
R5F10Y44 SET0     ; 16 pins
R5F10Y46 SET0     ; 16 pins
R5F10Y47 SET0     ; 16 pins
```

Figure 5.1 Selection of Product to be Used

After the product names are defined and then the settings of P0 relationships and clock relationships are described as follows, only the $IF control instruction including the R5F10Y16 becomes true and the codes between $ENDIF and $ELSEIF is subject to assembly. These settings vary with the product. The following is the example of PM0.

```
$NOLIST
$IF( R5F10Y16 +R5F10Y14 ==1 )
$LIST
;---------------------------------------------------------------
;       for 10 pins
;---------------------------------------------------------------
        MOV     PM0,    #11100000B     ; P00-P04 to output port

$NOLIST
$ELSEIF( R5F10Y44 + R5F10Y46 + R5F10Y47==1 )
$LIST
;---------------------------------------------------------------
;       for 16 pins
;---------------------------------------------------------------
        MOV     PM0,    #10000000B     ;P00-P06 to output port
$NOLIST
$ENDIF
```

Because including “R5F10Y16,” only these codes are subject to assembly.

These codes are not subject to assembly.

Figure 5.2 Example of Program

Remark The $LIST and $NOLIST control instructions are added to the assemble list file so that the settings of the devices not selected are not output. The addition of these instructions eliminates the necessity to see excess information, such as the $IF control instruction. Note that $LIST and $NOLIST are output.

5.2 Change of Target Product

When changing the target product to be used, create a project in the target product. Pass the project of the sample code at that time.

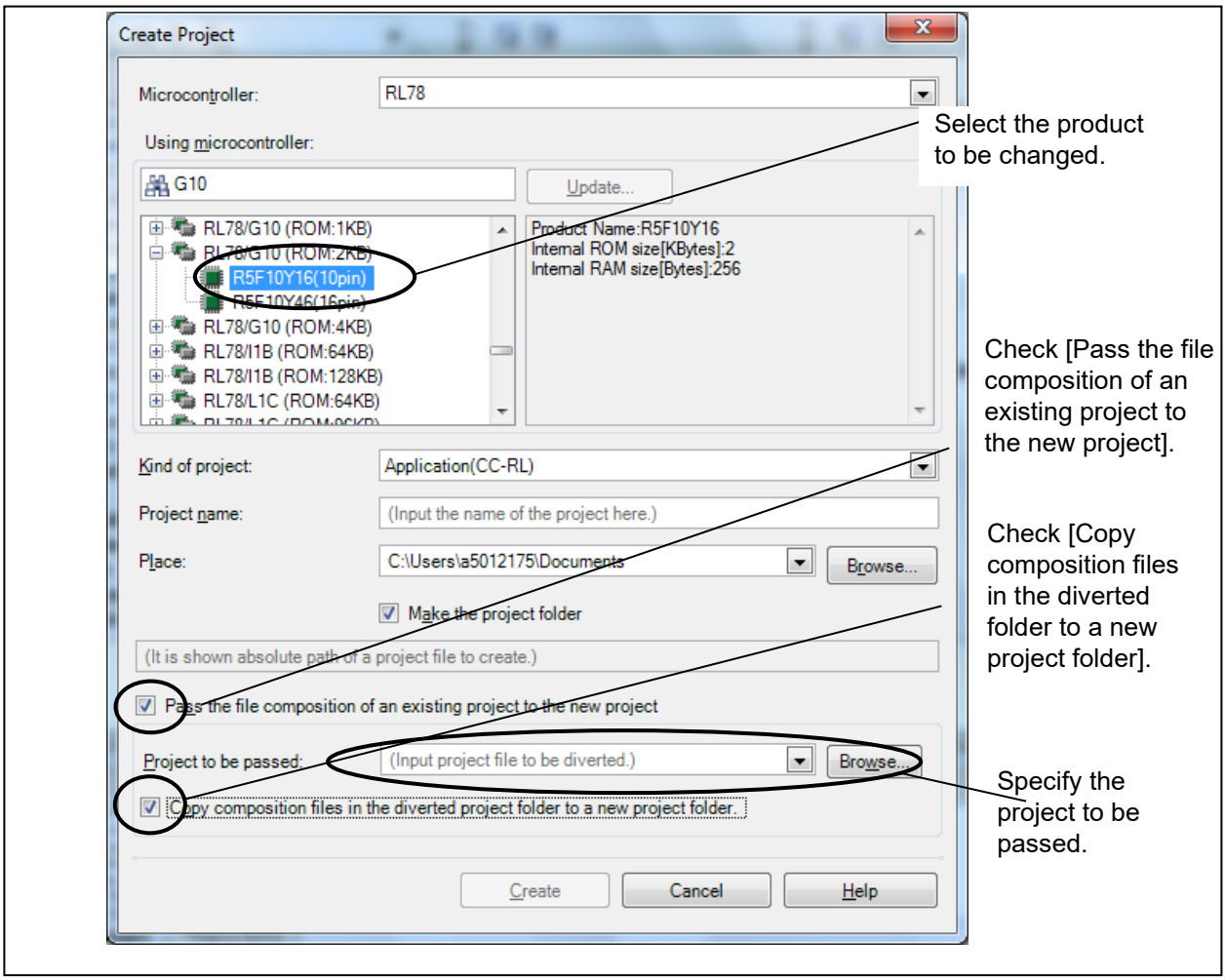


Figure 5.3 Example of Creating New Project when Changing the Target Product

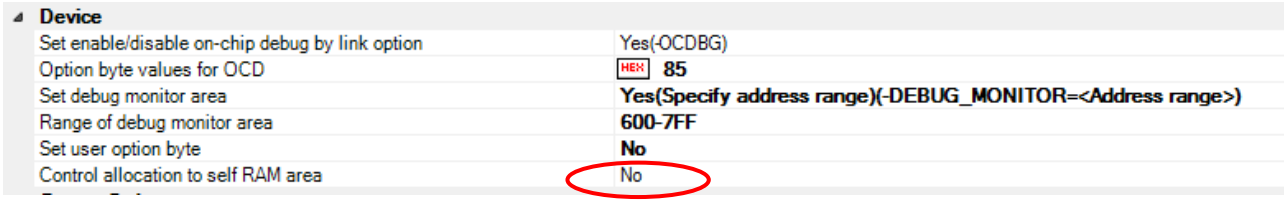
6. Caution on Using Sample Code

Because this sample code is described in assembly language, the code generating function of CS+ is not used. Consequently, some of the settings require attention.

6.1 Setting of CS+

This sample code should be described in assembly language and the functions prepared in CS+ should be prohibited.

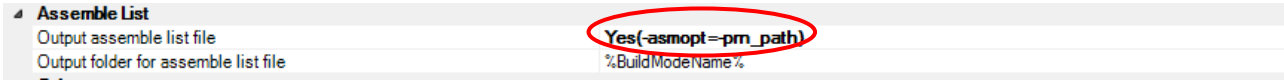
- Set the link options of the CC-RL property as shown below, otherwise a reset due to the watchdog timer may be executed regularly.



- Setting of assemble options

The following setting is not required but recommended. This setting allows outputting a list with the address after link fixed.

Open [Assemble List] and set [Output assemble list file] in the second top row to [**Yes**].



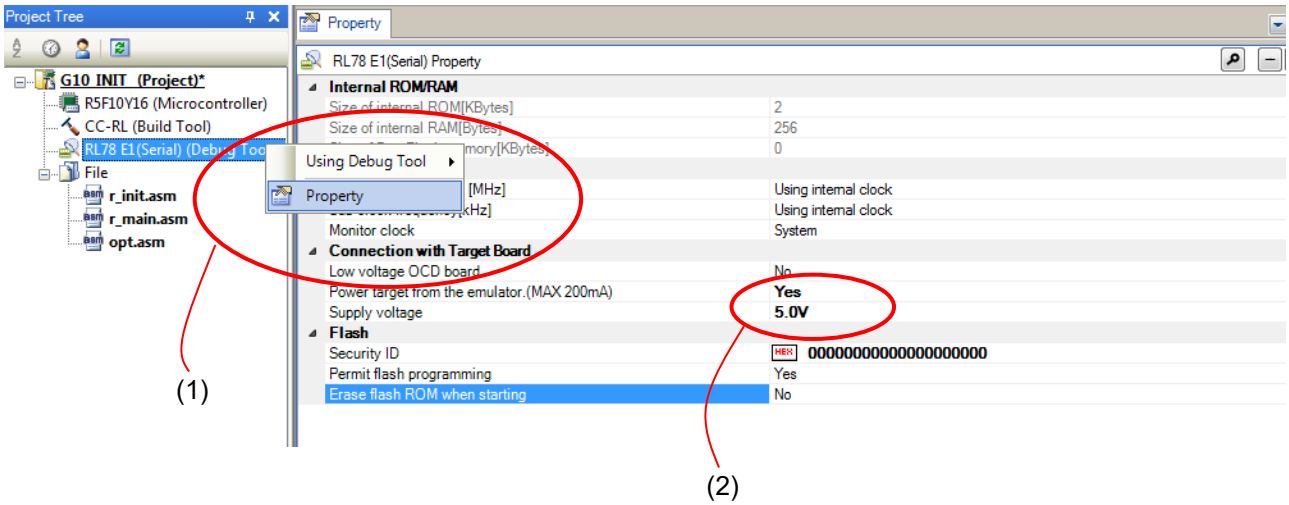
6.2 Setting of Debug Tool

Because this sample code allows checking the operation of the RL78/G10 target board (QB-R5F10Y16-TB) without using anything else together, the power can be supplied from the emulator to the target board. The debug tool can be used to debug simple circuits.

Set the debug tool as follows.

(1) Open [Property] of [RL78 E1(Serial) (Debug Tool)].

(2) Set [Power target from the emulator (MAX 200mA)] to [Yes] in [Connection with Target Board] and set [Supply voltage] to [5.0V].



7. Sample Code

The sample code is available on the Renesas Electronics Website.

8. Documents for Reference

RL78/G10 User's Manual: Hardware (R01UH0384E)

RL78 Family User's Manual: Software (R01US0015E)

(The latest versions of the documents are available on the Renesas Electronics Website.)

Technical Updates/Technical Brochures

(The latest versions of the documents are available on the Renesas Electronics Website.)

Revision Record	RL78/G10 Initialization CC-RL

Rev.	Date	Description	
		Page	Summary
1.00	Apr. 10, 2015	—	First edition issued
2.00	Nov. 11, 2015	4	Table 2.1: Added e2studio
		4	Table 2.1:Change the version information of CS+
2.10	June. 24, 2022	4	Operation check condition is updated.

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 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.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: “Standard” and “High Quality”. The intended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below.
   - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
   - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

   Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user’s manual or other Renesas Electronics document.
7. No semiconductor product is absolutely secure. Notwithstanding any security measures or features that may be implemented in Renesas Electronics hardware or software products, Renesas Electronics shall have absolutely no liability arising out of any vulnerability or security breach, including but not limited to any unauthorized access to or use of a Renesas Electronics product or a system that uses a Renesas Electronics product. RENESAS ELECTRONICS DOES NOT WARRANT OR GUARANTEE THAT RENESAS ELECTRONICS PRODUCTS, OR ANY SYSTEMS CREATED USING RENESAS ELECTRONICS PRODUCTS WILL BE INVULNERABLE OR FREE FROM CORRUPTION, ATTACK, VIRUSES, INTERFERENCE, HACKING, DATA LOSS OR THEFT, OR OTHER SECURITY INTRUSION (“Vulnerability Issues”). RENESAS ELECTRONICS DISCLAIMS ANY AND ALL RESPONSIBILITY OR LIABILITY ARISING FROM OR RELATED TO ANY VULNERABILITY ISSUES. FURTHERMORE, TO THE EXTENT PERMITTED BY APPLICABLE LAW, RENESAS ELECTRONICS DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THIS DOCUMENT AND ANY RELATED OR ACCOMPANYING SOFTWARE OR HARDWARE, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE.
8. When using Renesas Electronics products, refer to the latest product information (data sheets, user’s manuals, application notes, “General Notes for Handling and Using Semiconductor Devices” in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
12. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
13. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
14. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

(Rev.5.0-1 October 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit: www.renesas.com/contact/.

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.