
RL78/G14

R01AN2783EJ0100

Rev. 1.00

Setting the Window Comparator CC-RL

Apr 16, 2015

Abstract

This document describes a method to operate the window comparator using the RL78/G14 comparator.

Products

RL78/G14

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

Contents

1. Specifications	3
2. Operation Confirmation Conditions	4
3. Hardware	5
3.1 Hardware Configuration	5
3.2 Pins Used.....	5
4. Software	6
4.1 Operation Overview	6
4.2 Option-Setting Memory	6
4.3 Functions.....	6
4.4 Function Specifications	7
4.5 Flowcharts.....	8
4.5.1 Overall Flowchart.....	8
4.5.2 Initial Setting	8
4.5.3 Initial Setting of Peripheral Functions	9
4.5.4 Initial Setting of the CPU Clock	9
4.5.5 Initial Setting of the Comparator	10
4.5.6 Main Processing	16
4.5.7 Comparator 0 Operation Start Setting.....	16
5. Sample Code.....	17
6. Reference Documents.....	17

1. Specifications

Operate the window comparator using the comparator. When the following conditions for the analog input voltage are met, high level is output from the VCOU0 pin. When the conditions are not met, low level is output from the VCOU0 pin.

Reference on low-voltage side < analog input voltage < reference on high-voltage side

Table 1.1 lists the Peripheral Function and Its Application. Figure 1.1 shows the Operation Outline.

Table 1.1 Peripheral Function and Its Application

Peripheral Function	Application
Comparator	Compare the analog input voltage and reference voltage

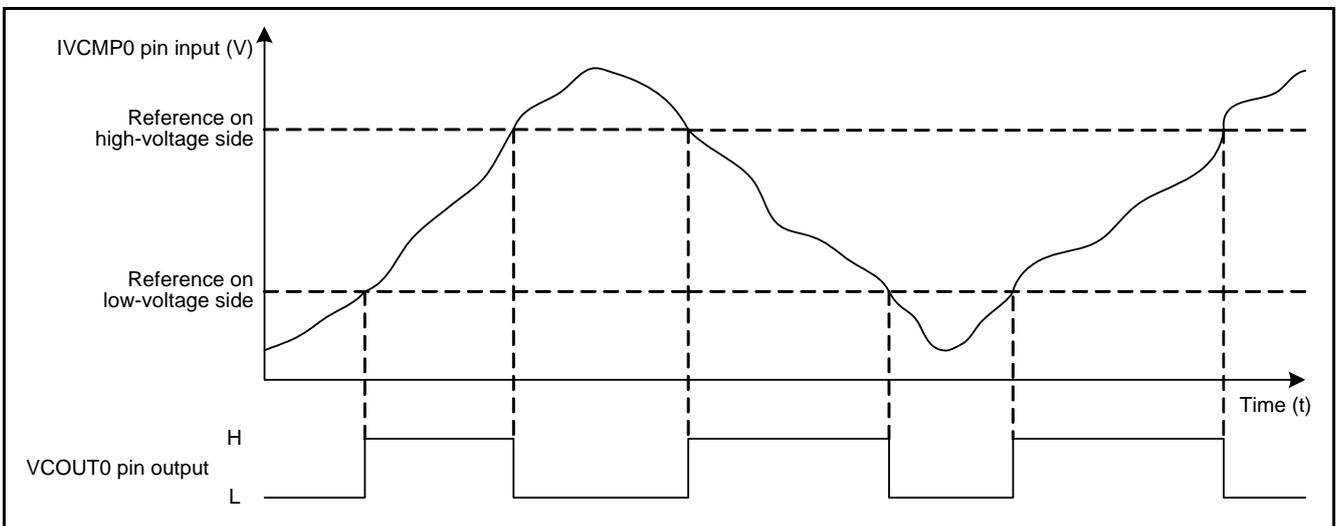


Figure 1.1 Operation Outline

2. Operation Confirmation Conditions

The sample code accompanying this application note has been run and confirmed under the conditions below.

Table 2.1 Operation Confirmation Conditions

Item	Contents
MCU used	RL78/G14 (R5F104PJA)
Operating frequencies	<ul style="list-style-type: none"> • High-speed on-chip oscillator clock (f_{HOCO}): 16 MHz (typical) • CPU/peripheral hardware clock (f_{CLK}): 16 MHz
Operating voltage	5.0 V (2.9 to 5.5 V) LVD operation (V _{LVD}): 2.81 V at the rising edge or 2.75 V at the falling edge in reset mode
Integrated development environment (CS+)	Renesas Electronics Corporation CS+ V3.01.00
C compiler (CS+)	Renesas Electronics Corporation CC-RL V1.01.00
Integrated development environment (e ² studio)	Renesas Electronics Corporation e ² studio V4.0.0.26
C compiler (e ² studio)	Renesas Electronics Corporation CC-RL V1.01.00

3. Hardware

3.1 Hardware Configuration

Figure 3.1 shows the Hardware Configuration used in this document.

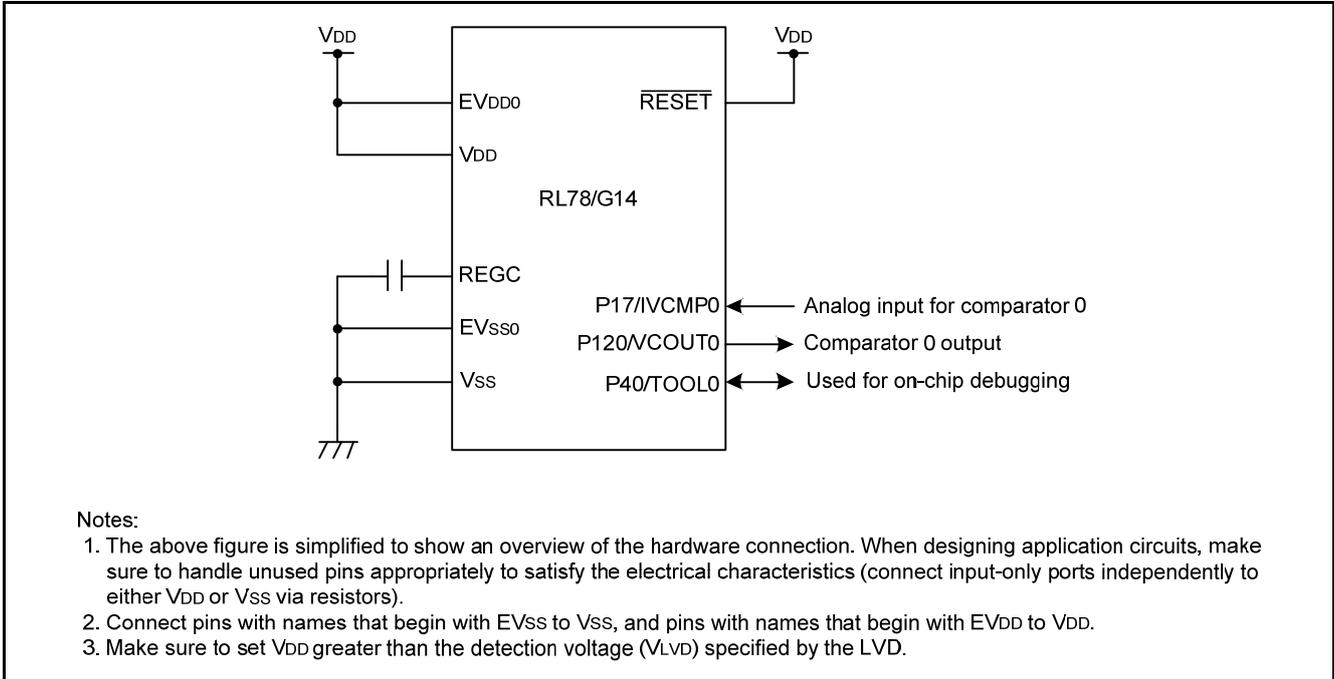


Figure 3.1 Hardware Configuration

3.2 Pins Used

Table 3.1 lists the Pins Used and Their Functions.

Table 3.1 Pins Used and Their Functions

Pin Name	I/O	Functions
P17/IVCMP0	Input	Analog input for comparator 0
P120/VCOU0	Output	Output for comparator 0

4. Software

4.1 Operation Overview

Use comparator 0 in window mode to operate the window comparator. Use a digital filter (sampling clock: $f_{CLK}/32$) and output the compared result for the filtered comparator from the VCOUT0 pin.

Comparator 0 settings are shown below.

Settings:

- Use high-speed mode for the comparator response speed.
- Use window mode for the operation mode.
- Use a digital filter. $f_{CLK}/32$ is selected for the sampling clock.
- Enable the VCOUT0 pin output of comparator 0.
- Output the comparator 0 output to the VCOUT0 pin.
- Do not use the comparator 0 interrupt.
- Use the IVCMP0 pin for the analog input.
- Use the VCOUT0 pin for the comparator 0 output.

4.2 Option-Setting Memory

Table 4.1 lists the Option-Setting Memory Configured in the Sample Code. When necessary, set a value suited to the user system.

Table 4.1 Option-Setting Memory Configured in the Sample Code

Address	Setting Value	Contents
000C0H/010C0H	11101111B	Watchdog timer operation is stopped (count is stopped after reset)
000C1H/010C1H	01111111B	LVD reset mode Detection voltage: Rising edge 2.81 V/falling edge 2.75 V
000C2H/010C2H	11101001B	Internal high-speed oscillation HS mode: 16 MHz
000C3H/010C3H	10000100B	On-chip debugging enabled

4.3 Functions

Table 4.2 lists the Functions.

Table 4.2 Functions

Function Name	Outline
hdwinit	Initial setting
R_Systeminit	Initial setting of peripheral functions
R_CGC_Create	Initial setting of the CPU clock
R_COMP_Create	Initial setting of the comparator
main	Main processing
R_COMP_Start	Comparator 0 operation start setting

4.4 Function Specifications

The following tables list the sample code function specifications.

hdwinit	
Outline	Initial setting
Header	None
Declaration	void hdwinit(void)
Description	Perform the initial setting of peripheral functions.
Argument	None
Return Value	None
R_Systeminit	
Outline	Initial setting of peripheral functions
Header	None
Declaration	void R_Systeminit(void)
Description	Perform the initial setting of peripheral functions used in this document.
Argument	None
Return Value	None
R_CGC_Create	
Outline	Initial setting of the CPU clock
Header	r_cg_cgc.h
Declaration	void R_CGC_Create(void)
Description	Perform the initial setting of the CPU clock.
Argument	None
Return Value	None
R_COMP_Create	
Outline	Initial setting of the comparator
Header	r_cg_comp.h
Declaration	void R_COMP_Create(void)
Description	Perform the initial setting to use the comparator in window mode.
Argument	None
Return Value	None
main	
Outline	Main processing
Header	None
Declaration	void main(void)
Description	Perform main processing.
Argument	None
Return Value	None

R_COMP0_Start

Outline	Comparator 0 operation start setting
Header	r_cg_comp.h
Declaration	void R_COMP0_Start(void)
Description	Start window comparator operation
Argument	None
Return Value	None

4.5 Flowcharts

4.5.1 Overall Flowchart

Figure 4.1 shows the Overall Flowchart.

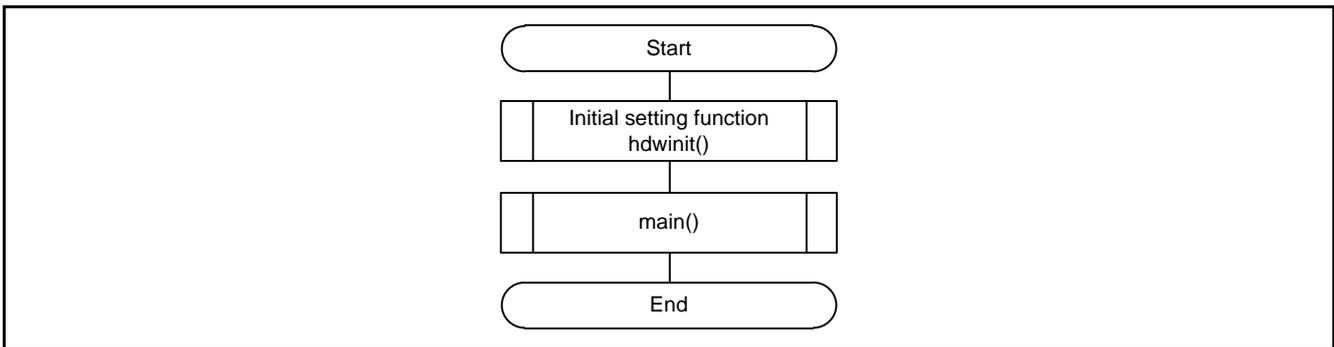


Figure 4.1 Overall Flowchart

4.5.2 Initial Setting

Figure 4.2 shows the Initial Setting.

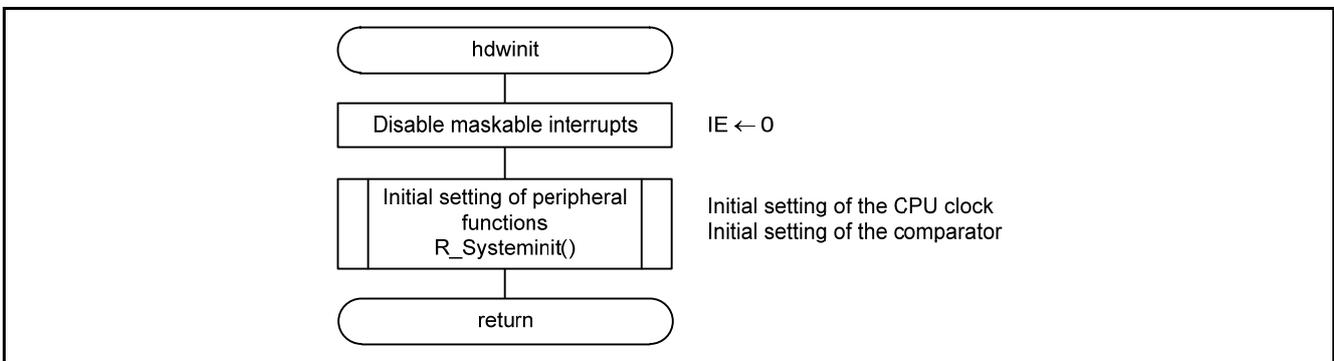


Figure 4.2 Initial Setting

4.5.3 Initial Setting of Peripheral Functions

Figure 4.3 shows the Initial Setting of Peripheral Functions.

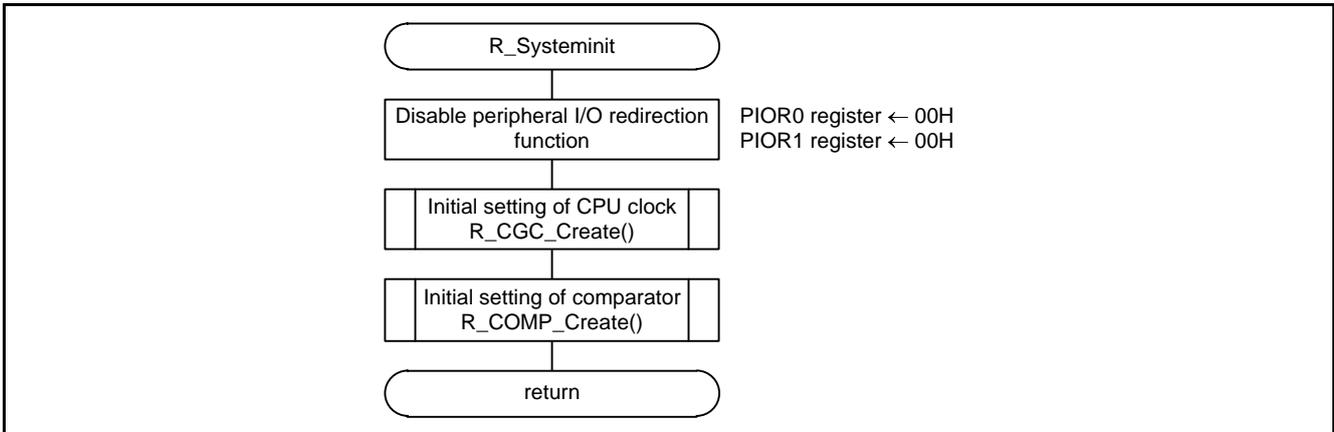


Figure 4.3 Initial Setting of Peripheral Functions

4.5.4 Initial Setting of the CPU Clock

Figure 4.4 shows the Initial Setting of the CPU Clock.

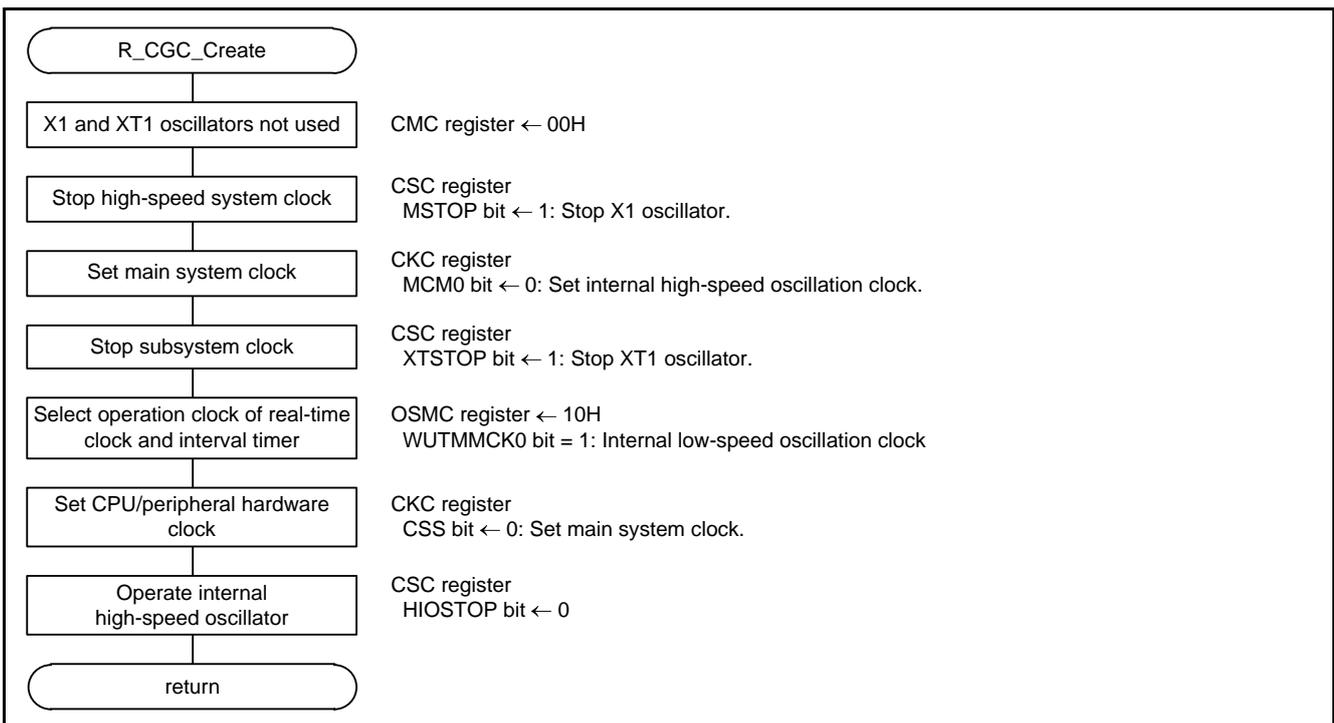


Figure 4.4 Initial Setting of the CPU Clock

4.5.5 Initial Setting of the Comparator

Figure 4.5 shows the Initial Setting of the Comparator.

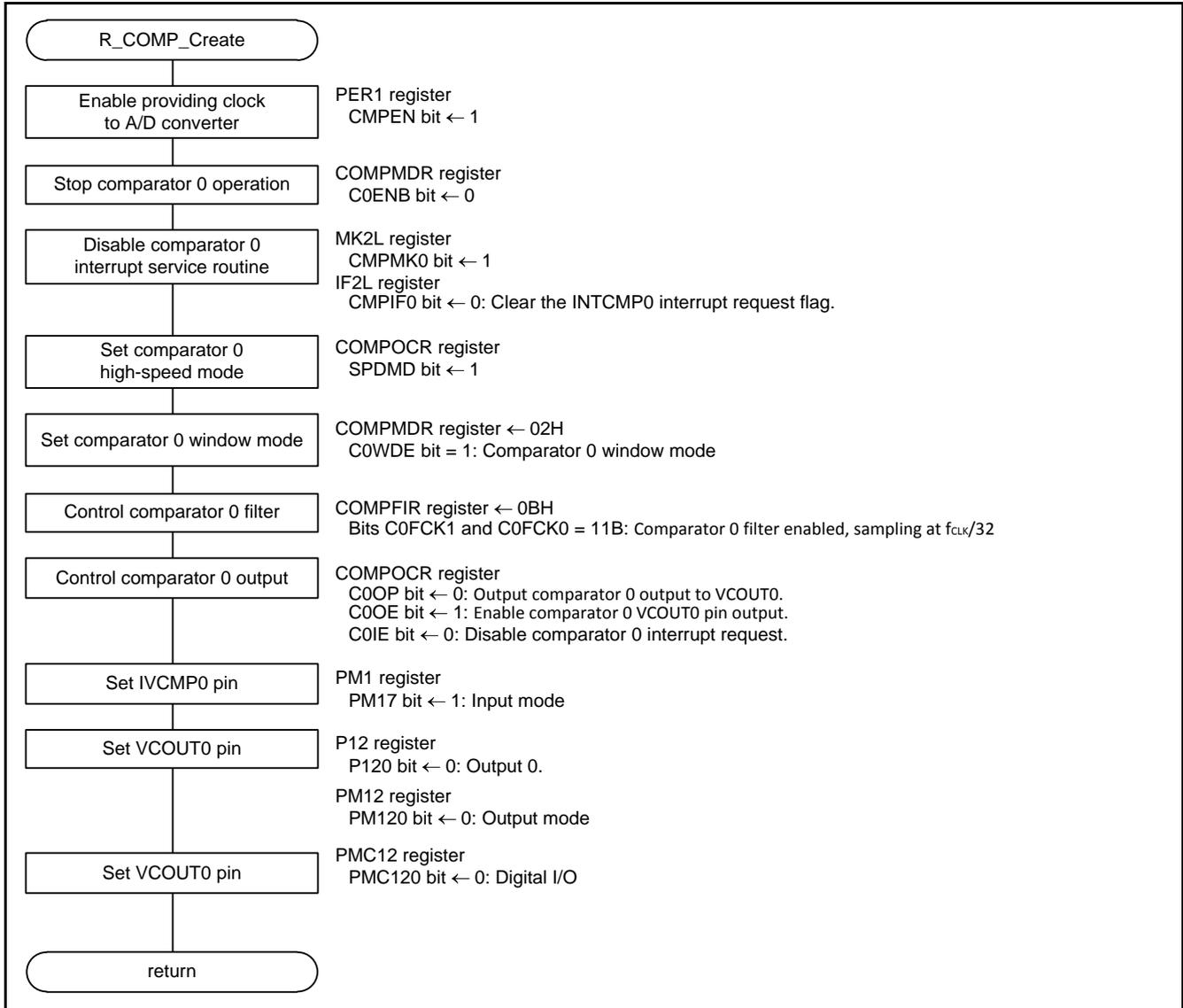


Figure 4.5 Initial Setting of the Comparator

Enable providing a clock to the comparator.

- Peripheral Enable Register 1 (PER1)

Symbol	7	6	5	4	3	2	1	0
PER1	DACEN	TRGEN	COMPEN	TRD0EN	DTCEN	0	0	TRJ0EN
Setting Value	x	x	1	x	x	—	—	x

Bit 5

COMPEN	Control of comparator input clock supply
0	Stops input clock supply. <ul style="list-style-type: none"> SFR used by comparator cannot be written. Comparator is in the reset status.
1	Enables input clock supply. <ul style="list-style-type: none"> SFR used by comparator can be read and written.

Stop comparator 0 operation.

- Comparator Mode Setting Register (COMPMDR)

Symbol	7	6	5	4	3	2	1	0
COMPMDR	C1MON	C1VRF	C1WDE	C1ENB	C0MON	C0VRF	C0WDE	C0ENB
Setting Value	x	x	x	x		x		0

Bit 0

C0ENB	Comparator 0 operation enable
0	Comparator 0 operation disabled
1	Comparator 0 operation enabled

Refer to the RL78/G14 user's manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

Disable the comparator 0 interrupt service routine.

- Interrupt Mask Flag Register (MK2L)

Symbol	7	6	5	4	3	2	1	0
MK2L	PMK10 CMPMK0	PMK9	PMK8	PMK7	PMK6	TMMK13	TMMK12	TMMK11
Setting Value	1	x	x	x	x	x	x	x

Bit 7

CMPMK0	Interrupt servicing control
0	Interrupt servicing enabled
1	Interrupt servicing disabled

- Interrupt Request Flag Register (IF2L)

Symbol	7	6	5	4	3	2	1	0
IF2L	PIF10 CMPIF0	PIF9	PIF8	PIF7	PIF6	TMIF13	TMIF12	TMIF11
Setting Value	0	x	x	x	x	x	x	x

Bit 7

CMPIF0	Interrupt request flag
0	No interrupt request signal is generated
1	Interrupt request is generated, interrupt request status

Set comparator 0 high-speed mode.

- Comparator Output Control Register (COMPOCR)

Symbol	7	6	5	4	3	2	1	0
COMPOCR	SPDMD	C1OP	C1OE	C1IE	0	COOP	COOE	COIE
Setting Value	1	x	x	x	—			

Bit 7

SPDMD	Comparator speed selection
0	Comparator low-speed mode
1	Comparator high-speed mode

Refer to the RL78/G14 user’s manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

Set comparator 0 window mode.

- Comparator Mode Setting Register (COMPMDR)

Symbol	7	6	5	4	3	2	1	0
COMPMDR	C1MON	C1VRF	C1WDE	C1ENB	C0MON	C0VRF	C0WDE	C0ENB
Setting Value	x	x	x	x		x	1	

Bit 1

C0WDE	Comparator 0 window mode selection
0	Comparator 0 standard mode
1	Comparator 0 window mode

Control the comparator 0 filter.

- Comparator Filter Control Register (COMPFIR)

Symbol	7	6	5	4	3	2	1	0
COMPFIR	C1EDG	C1EPO	C1FCK1	C1FCK0	C0EDG	C0EPO	C0FCK1	C0FCK0
Setting Value	x	x	x	x	x	x	1	1

Bits 1 and 0

C0FCK1	C0FCK0	Comparator 0 filter selection
0	0	No comparator 0 filter
0	1	Comparator 0 filter enabled, sampling at f_{CLK}
1	0	Comparator 0 filter enabled, sampling at f_{CLK8}
1	1	Comparator 0 filter enabled, sampling at $f_{CLK}/32$

Refer to the RL78/G14 user's manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

Control comparator 0 output.

- Comparator Output Control Register (COMPOCR)

Symbol	7	6	5	4	3	2	1	0
COMPOCR	SPDMD	C1OP	C1OE	C1IE	0	C0OP	C0OE	C0IE
Setting Value		x	x	x	—	0	1	0

Bit 2

C0OP	VCOU0 output polarity selection
0	Comparator 0 output is output to VCOU0
1	Inverted comparator 0 output is output to VCOU0

Bit 1

C0OE	VCOU0 pin output enable
0	Comparator 0 VCOU0 pin output disabled
1	Comparator 0 VCOU0 pin output enabled

Bit 0

C0IE	Comparator 0 interrupt request enable
0	Comparator 0 interrupt request disabled
1	Comparator 0 interrupt request enabled

Set the IVCMP0 pin.

- Port Mode Register 1 (PM1)

Symbol	7	6	5	4	3	2	1	0
PM1	PM17	PM16	PM15	PM14	PM13	PM12	PM11	PM10
Setting Value	1	x	x	x	x	x	x	x

Bit 7

PM17	P17 pin I/O mode selection
0	Output mode (output buffer on)
1	Input mode (output buffer off)

Refer to the RL78/G14 user's manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

Set the VCOUT0 pin.

- Port Register 12 (P12)

Symbol	7	6	5	4	3	2	1	0
P12	0	0	0	P124	P123	P122	P121	P120
Setting Value	—	—	—	x	x	x	x	0

Bit 0

P120	Output data control
0	Output 0
1	Output 1

- Port Mode Register 1 (PM12)

Symbol	7	6	5	4	3	2	1	0
P12	1	1	1	1	1	1	1	PM120
Setting Value	—	—	—	—	—	—	—	0

Bit 0

PM120	P120 pin I/O mode selection
0	Output mode (output buffer on)
1	Input mode (output buffer off)

Set the VCOUT0 pin.

- Port Mode Control Register (PMC12)

Symbol	7	6	5	4	3	2	1	0
PMC12	1	1	1	1	1	1	1	PMC120
Setting Value	—	—	—	—	—	—	—	0

Bit 0

PMC120	P120 pin digital I/O and analog input selection
0	Digital I/O (multiplexed function other than analog input)
1	Analog input

Refer to the RL78/G14 user's manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

4.5.6 Main Processing

Figure 4.6 shows the Main Processing.

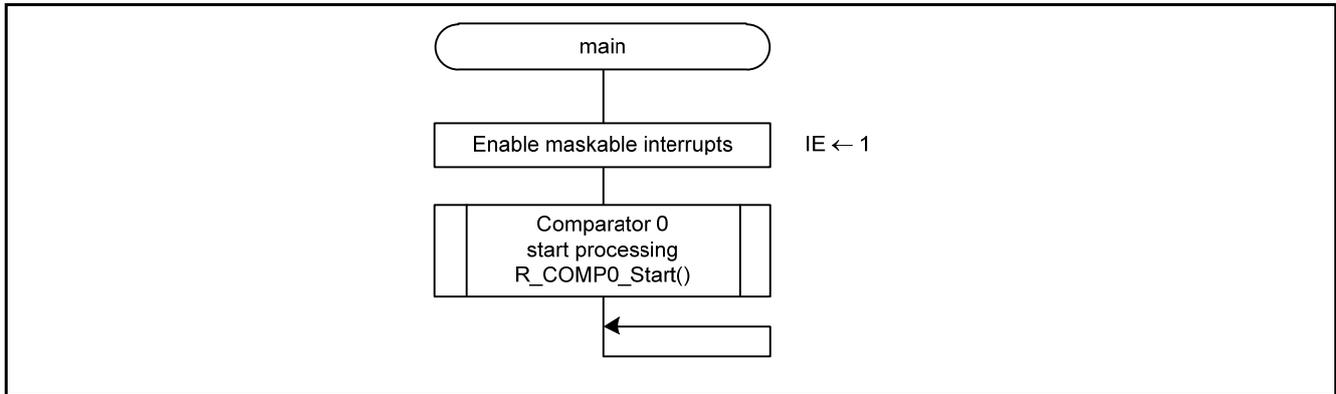


Figure 4.6 Main Processing

4.5.7 Comparator 0 Operation Start Setting

Figure 4.7 shows the Comparator 0 Operation Start Setting.

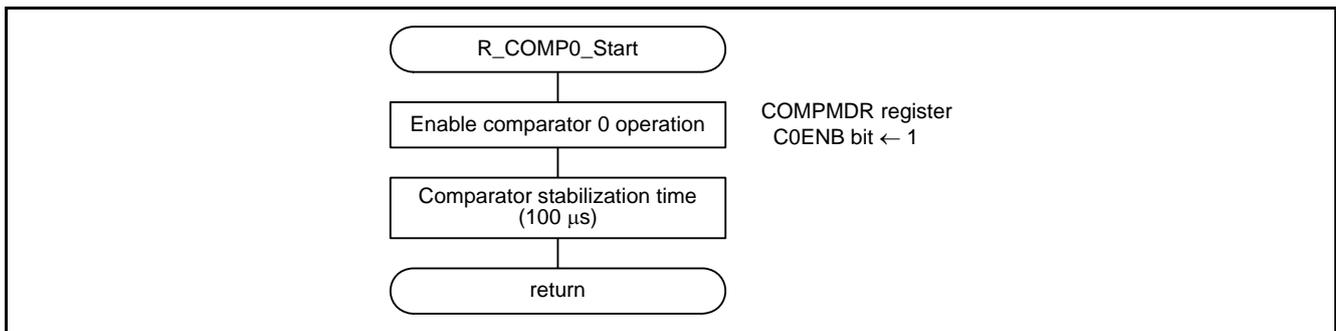


Figure 4.7 Comparator 0 Operation Start Setting

Enable comparator 0 operation.

- Comparator Mode Setting Register (COMPMDR)

Symbol	7	6	5	4	3	2	1	0
COMPMDR	C1MON	C1VRF	C1WDE	C1ENB	C0MON	C0VRF	C0WDE	C0ENB
Setting Value	x	x	x	x		x		1

Bit 0

C0ENB	Comparator 0 operation enable
0	Comparator 0 operation disabled
1	Comparator 0 operation enabled

Refer to the RL78/G14 user’s manual (hardware) for details on individual registers.

Initial values of individual bits

x: Bits not used in this application; blank spaces: bits that do not change; —: reserved bits or bits that have nothing assigned.

5. Sample Code

Sample code can be downloaded from the Renesas Electronics website.

6. Reference Documents

User's Manual: Hardware

RL78/G14 Group User's Manual: Hardware Rev.0.02

RL78 Family User's Manual: Software Rev.1.00

The latest versions can be downloaded from the Renesas Electronics website.

Technical Update/Technical News

The latest information can be downloaded from the Renesas Electronics website.

Website and Support

Renesas Electronics website

<http://www.renesas.com>

Inquiries

<http://www.renesas.com/contact/>

REVISION HISTORY	RL78/G14 Setting the Window Comparator
-------------------------	--

Rev.	Date	Description	
		Page	Summary
1.00	Apr. 16, 2015	—	First edition issued

All trademarks and registered trademarks are the property of their respective owners.

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU 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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.

5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

- The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the 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 of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. Renesas Electronics does not assume any liability for infringement of 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. 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 should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended 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; and industrial robots etc.
"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc.
Renesas Electronics products are neither intended nor 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 damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, 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, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may 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 should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.



SALES OFFICES

Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709, Quantum Plaza, No.27 ZhichunLu Haidian District, Beijing 100191, P.R.China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, P. R. China 200333
Tel: +86-21-2226-0888, Fax: +86-21-2226-0899

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-8688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jin Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL II Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141