RL78/G14, H8/3687 Group

Migration Guide from H8/3687 to RL78/G14: Clock Generator

R01AN1988EJ0100
Rev.1.00
Mar. 03, 2014

Abstract

This application note explains how to migrate from the clock generator of the H8/3687 Group to that of RL78/G14.

Target Devices

RL78/G14, H8/3687 Group

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

Contents

1. Differences between the H8/3687 Group and RL78/G14

Table 1.1 and Table 1.2 show outlined specifications of the clock generators of the H8/3687 Group and RL78/G14. In addition, Table 1.3 describes differences in the clock generators.

Table 1.1 Outlined Specification of Clock Generator (H8/3687 Group)

Item	System clock oscillator	Subclock oscillator
Application	• Clock source for CPU • Clock source for peripheral functions	
Clock frequency	0 to 20 MHz	32.768 kHz
Connectable resonator	• Ceramic resonator • Crystal resonator	Crystal resonator
Connection pin of resonator	OSC1, OSC2	X1, X2
Divider	Divided by 1, 8, 16, 32, 64	Divided by 2, 4, 8
Status after reset	Oscillating	Oscillating
Other features	An externally generated clock can be input.	

Table 1.2 Outlined Specification of Clock Generator (RL78/G14)

Item	Main system clock		Subsystem clock oscillator	Low-speed on-chip oscillator
	High-speed system clock oscillator	High-speed on-chip oscillator		
Application	• Clock source for CPU • Clock source for peripheral functions	• Clock source for CPU • Clock source for peripheral functions	• Clock source for CPU • Clock source for peripheral functions	• Watchdog timer • Real-time clock • 12-bit interval timer • Timer RJ
Clock frequency	1 to 20 MHz	64 MHz (TYP.)(Note 1)	32.768 kHz	15 kHz (TYP.)
Connectable resonator	• Ceramic resonator • Crystal resonator	–	Crystal resonator	–
Connection pin of resonator	X1, X2	–	XT1, XT2	–
Oscillation start/ stop function	Available			
Status after reset	Stopped	Oscillating	Stopped	Oscillating/stopped (Note 2)
Other features	An externally generated clock can be input.	–	An externally generated clock can be input.	–

Notes:

1. When 64 MHz or 48 MHz is selected as oscillation frequency, the selected clock divided-by-2 is supplied to the CPU clock.
2. This status can be selected by setting the WDTON bit in the user option byte (000C0H).

Table 1.3 Differences in the Clock Generators

Item	H8/3687 Group	RL78/G14
Oscillation accuracy of high-speed on-chip oscillator	No high-speed on-chip oscillator is mounted.	± 1 % (Note 1)
How to change oscillation frequency of high-speed on-chip oscillator	No high-speed on-chip oscillator is mounted.	By setting the FRQSEL4 to FRQSEL0 bits of the user option byte (000C2H), following frequencies may be selected. • 64 MHz • 48 MHz • 32 MHz • 24 MHz • 16 MHz • 12 MHz • 8 MHz • 4 MHz • 1 MHz
Oscillation stabilization time of high-speed on-chip oscillator	No high-speed on-chip oscillator is mounted.	Included in the reset processing time Reset processing time: • When LVD is off: 417 µs (TYP.), 554 µs (MAX.) • When LVD is on: 690 µs (TYP.), 867 µs (MAX.)
Oscillation accuracy of low-speed on-chip oscillator	No low-speed on-chip oscillator is mounted.	± 15 %
Duty correction circuit	Available for the system clock oscillator	N/A
CPU clock divider	Available (Note 2)	Available only in the high-speed on-chip oscillator
CPU clock after reset release	System clock oscillator	High-speed on-chip oscillator
Oscillation mode selection function of subsystem clock	N/A	Available

Notes

1. Measurement conditions of V_{DD}: 1.8 V to 5.5 V, -20 to +85 ˚C
2. Division ratio after a SLEEP instruction is executed is used.

1.1 System Clock Oscillator

Clocks generated by the system clock oscillator of the H8/3687 Group may be used as the clock source for the CPU clock and peripheral function clock. When using the system clock oscillator, connect a crystal resonator or ceramic resonator to the OSC1 and OSC2 pins. A clock generated externally can be also used by inputting it to the OSC1 pin. Table 1.4 lists the operating frequency and supply voltage (V_{CC}) of the system clock oscillator.

Table 1.4 Operating Frequency and Supply Voltage of System Clock of the H8/3687 Group

Item	Operating frequency	Vcc
System clock oscillator ϕ OSC	1 to 20 MHz	4.0 V ≤ Vcc ≤ 5.5 V
	1 to 10 MHz	3.0 V ≤ Vcc < 4.0 V
System clock oscillator ϕ OSC8 to ϕ OSC64	0.078125 to 2.5 MHz	4.0 V ≤ Vcc ≤ 5.5 V
	0.078125 to 1.25 MHz	3.0 V ≤ Vcc < 4.0 V

Clocks generated by the high-speed system clock oscillator of RL78/G14 can be used as the clock source for the CPU clock and peripheral function clock. When using the high-speed system clock oscillator, connect a crystal resonator or ceramic resonator to the X1 and X2 pins. A clock generated externally may also be used by inputting it to the EXCLK pin. Table 1.5 shows a relationship between operating frequency and supply voltage (V_{DD}) of the RL78/G14 high-speed system clock oscillator.

Table 1.5 Operating Frequency and Supply Voltage of the RL78/G14 High-speed System Clock Oscillator

Item	Operating frequency	VDD
High-speed system clock oscillator	1 to 20 MHz	2.7 V ≤ VDD ≤ 5.5 V
	1 to 16 MHz	2.4 V ≤ VDD < 2.7 V
	1 to 8 MHz	1.8 V ≤ VDD < 2.4 V
	1 to 4 MHz	1.6 V ≤ VDD < 1.8 V

Figure 1.1 illustrates a comparison of operating frequencies of the system clock oscillator of the H8/3687 Group and the high-speed system clock oscillator of RL78/G14.

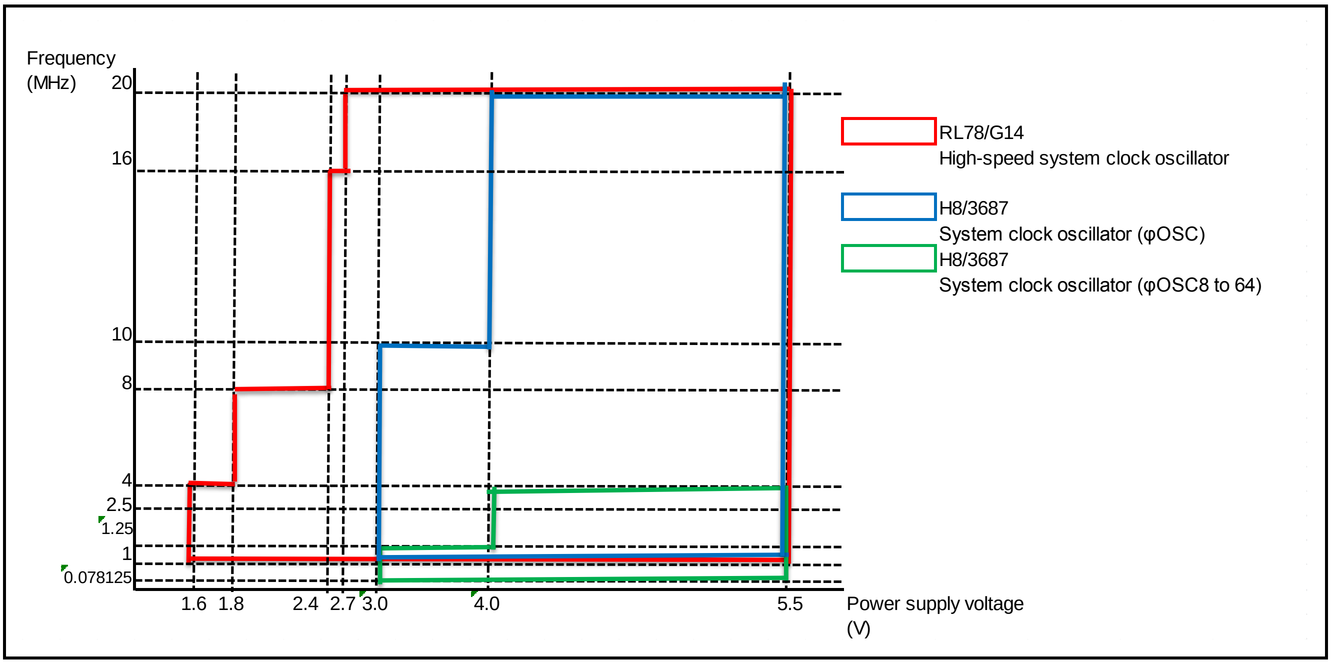

Figure 1.1 Comparison of Operating Frequencies of System Clock Oscillators

1.2 High-speed On-chip Oscillator

The H8/3687 Group does not have a high-speed on-chip oscillator.

Clocks generated by the high-speed on-chip oscillator of RL78/G14 can be used as the clock source for the CPU clock and peripheral function clock. The oscillation frequency can be selected from f_{HOCO} = 64 MHz, 48 MHz, 32 MHz, 24 MHz, 16 MHz, 12 MHz, 8 MHz, 4 MHz or 1 MHz by setting the user option byte. When 64 MHz or 48 MHz is selected as f_{HOCO}, f_{IH} is set to 32 MHz or 24 MHz, respectively. When 32 MHz or less is selected as f_{HOCO}, f_{IH} is not divided and set to the same frequency as f_{HOCO}. After a reset release, the high-speed on-chip oscillator clock is set as the CPU clock. Table 1.6 shows a relationship between the operating frequency and supply voltage (V_{DD}) of the RL78/G14 high-speed on-chip oscillator.

Table 1.6 Operating frequency and Supply Voltage of the RL78/G14 High-speed On-chip Oscillator

Item	Operating frequency	V_{DD}
High-speed on-chip oscillator	1 to 32 MHz (TYP.)	1.6 V ≤ V_{DD} ≤ 5.5V

Figure 1.2 shows a comparison of operating frequencies of the high-speed on-chip oscillator of RL78/G14.

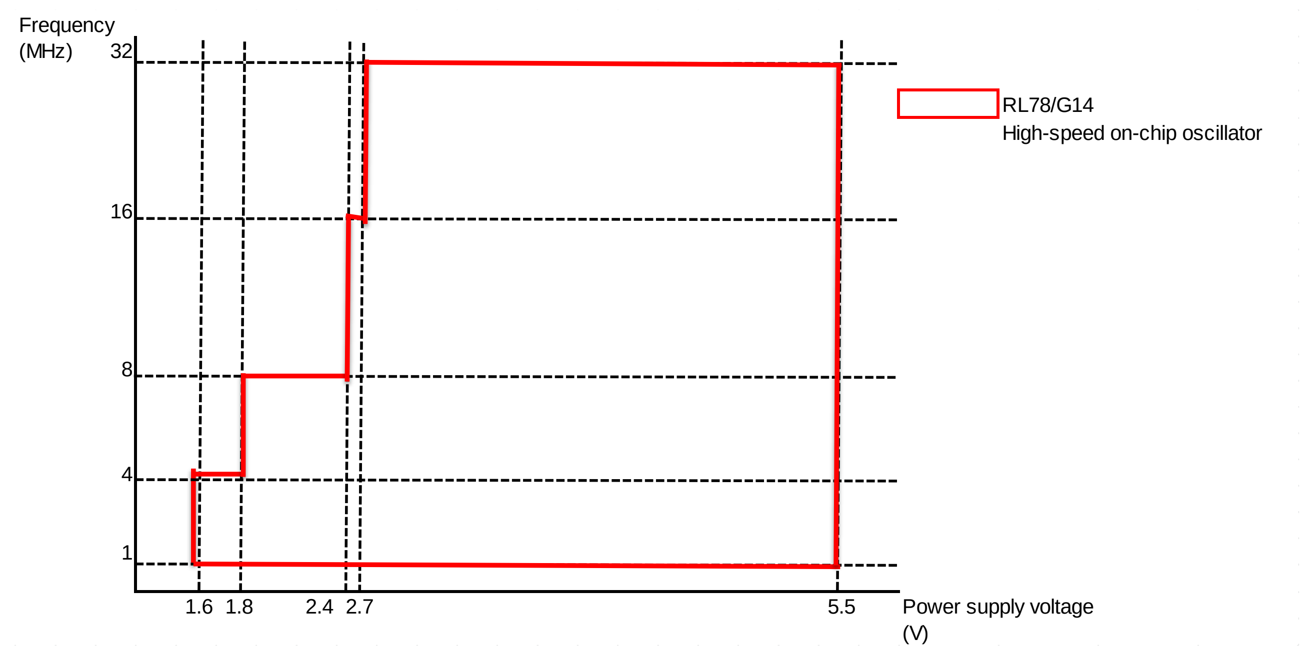

Figure 1.2 Comparison of Operating Frequencies of the High-speed On-chip Oscillator

1.3 Subclock Oscillator

Clocks generated by the subclock oscillator of the H8/3687 Group may be used as the clock source for the CPU clock and peripheral function clock. When using the subclock oscillator, connect a crystal resonator to the X1 and X2 pins. Table 1.7 lists operating frequency and supply voltage (V_{CC}) of the subclock oscillator.

Table 1.7 Operating frequency and Supply Voltage of Subclock Oscillator of the H8/3687 Group

Item	Operating frequency	VCC
Subclock oscillator	4.096 to 16.384 kHz	3.0 V ≤ VCC ≤ 5.5 V

Clocks generated by the XT1 oscillator of RL78/G14 can be used as the clock source for the CPU clock and peripheral function clock. Selecting the oscillation mode enables the XT1 oscillator to change consumption power and oscillation margin. When using the XT1 oscillator, connect a crystal resonator to the XT1 and XT2 pins. An external clock can be also used by inputting it to the EXCLKS pin. Table 1.8 shows the operating frequency and supply voltage (VDD) of the RL78/G14 subsystem clock oscillator.

Table 1.8 Operating frequency and Supply Voltage of Subsystem Clock Oscillator of RL78/G14

Item	Operating frequency	VDD
Subsystem clock oscillator	32 to 35 kHz	1.6 V ≤ VDD ≤ 5.5 V

Figure 1.3 illustrates a comparison of operating frequencies of the subclock oscillator of the H8/3687 Group and the subsystem clock oscillator of RL78/G14.

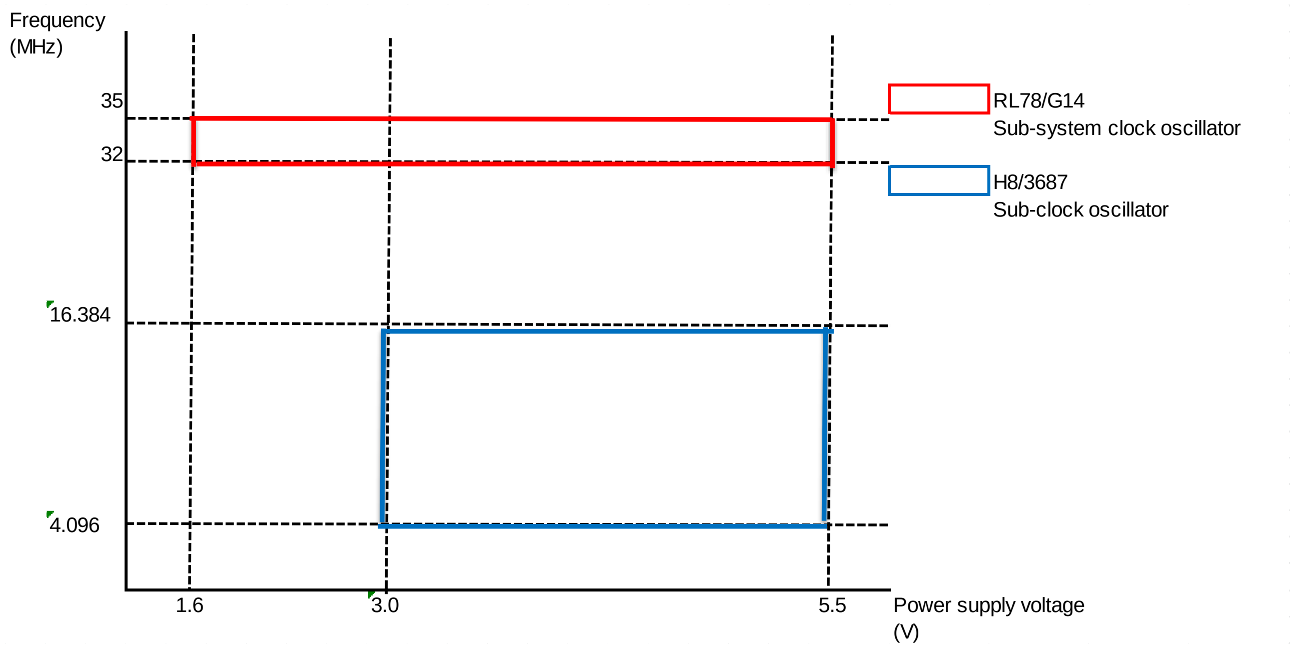

Figure 1.3 Comparison of Operating Frequencies of XCIN Clock Oscillators

1.4 Low-speed On-chip Oscillator

The H8/3687 Group does not have a low-speed on-chip oscillator.

Clocks generated by the low-speed on-chip oscillator of RL78/G14 can be used as the clock source for the watchdog timer, real-time clock, 12-bit interval timer, and timer RJ. However, it may not be used as the CPU clock source. After reset release, this clock stops when the bit 4 (WDTON) of the option byte (000C0H) is set to 0 and it oscillates when the bit is 1. Table 1.9 shows a relationship between the operating frequency and supply voltage (V_{DD}) of the RL78/G14 low-speed on-chip oscillator.

Table 1.9 Operating frequency and Supply Voltage of Low-speed On-chip Oscillator of RL78/G14

Item	Operating frequency	V_{DD}
Low-speed on-chip oscillator	15 kHz (TYP.)	1.6 V ≤ V_{DD} ≤ 5.5 V

Figure 1.4 shows a comparison of operating frequencies of the low-speed on-chip oscillator of RL78/G14.

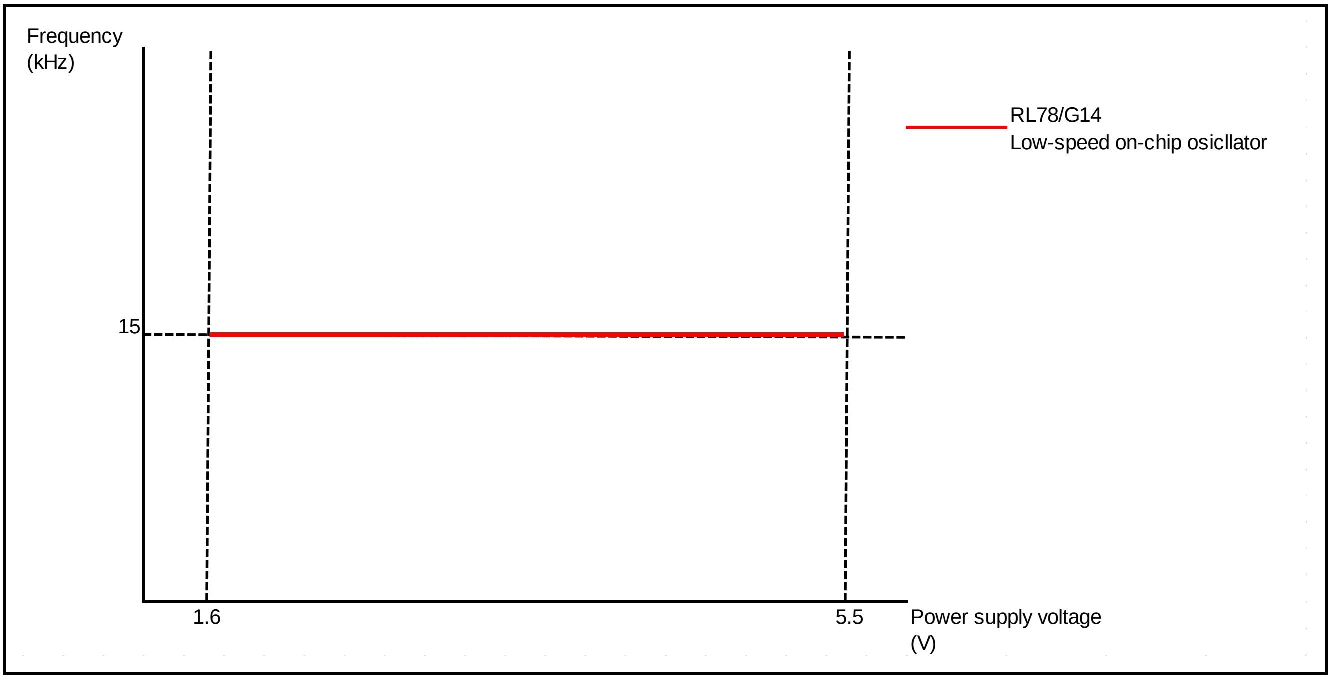

Figure 1.4 Comparison of Operating Frequencies of the Low-speed On-chip Oscillator

2. Terms

Terms for the H8/3687 Group and RL78/G14 are compared in Table 2.1.

Table 2.1 Comparison of Terms for the H8/3687 Group and RL78/G14

Item	H8/3687 Group	RL78/G14
Oscillator	System clock oscillator	High-speed system clock oscillator X1 oscillator
	–	High-speed on-chip oscillator
	Subclock oscillator	Subsystem clock oscillator XT1 oscillator
	–	Low-speed on-chip oscillator
Supply voltage	V_{CC}	V_{DD}

3. Reference Documents

RL78/G14 User's Manual: Hardware Rev. 2.00
H8/3687 Group Hardware Manual Rev.5.00
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, H8/3687 Group Application Note Migration Guide from H8/3687 to RL78/G14: Clock Generator

Rev.	Date	Description	
		Page	Summary
1.00	Mar.3,2014	—	First edition issued

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.

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.
2880 Scott Boulevard Santa Clara, CA 95050-2554, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130

Renesas Electronics Canada Limited
1101 Nicholson Road, Newmarket, Ontario L3Y 9C3, Canada
Tel: +1-905-898-5441, Fax: +1-905-898-3220

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-65030, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
7th Floor, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100083, 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 Rd., Putuo District, Shanghai, China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1613, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2886-9318, Fax: +852 2886-9022/9044

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei, 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 906, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

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

Colophon 3.0