SH74572

RENESAS MCU

R01DS0189EJ0120
Rev.01.20
Sep 10, 2012

1. Overview

The SH7457 Group is a single-chip RISC (reduced instruction set computer) microcontroller based on a Renesas original RISC CPU core.

Basically the SH7457 Group is the same as the SH7456 Group. Please refer to SH7455 Group, SH7456 Group User's Manual: Hardware Rev.1.10 (Sep 22, 2011). Table 1.1 shows the differences between the SH7456 Group and the SH7457 Group.

* Henceforth, the bold letter portion (shaped portion) shows a difference from SH7456 Group.

Table 1.1 Products

Group	Product	Model	CPU Frequency	Memory Capacity	Package	FlexRay	Operating temperature (Ta)
SH7457	**SH74572**	**R5F74572LBG**	**240**MHz	ROM: 1 Mbyte	PRBG0176GA-A	Yes	-40 to +**105**°C
SH7455	SH74552	R5F74552KBG	160MHz	IL memory: 8 Kbytes,		Yes	-40 to +125°C
SH7456	SH74562	R5F74562KBG		OL memory: 16 Kbytes, and SHwyRAM: 256 Kbytes		No	
SH7459	SH74593	R5F74593LBG	240MHz	ROM: 1.5 Mbytes IL memory: 8 Kbytes, OL memory: 16 Kbytes, and SHwyRAM: 512 Kbytes		Yes	-40 to +105°C

2. Details

This section shows the details of the difference from SH7455 Group, SH7456 Group User's Manual: Hardware Rev.1.10 (Sep 22, 2011). Table 2.1 shows the difference between the SH74562 and the SH74572.

Table 2.1 Difference between SH74562 and SH74572

Page	Description
1-4	• Table 1.1 Specifications Overview: Descriptions of CPG Product CPU clock (Ick) SH74562 160 MHz maximum SH74572 **240** MHz maximum
1-6	• Table 1.1 Specifications Overview: Descriptions of FlexRay Product Channels of FlexRay SH74562 None: SH7456 Group SH74572 **Two channels**: **SH7457** Group

Page	Description
1-7	• Table 1.1 Specifications Overview: Descriptions of Operating temperature Product Model SH74562 Ta = –40°C to +125°C SH74572 Ta = –40°C to +**105**°C
	• Table 1.2 Products Product Model FlexRay SH74562 R5F74562KBG No SH74572 **R5F74572LBG** **Yes** Please refer to Appendix A.
1-8	• Figure 1.1 Block Diagram Product SH-4A core clock SH74562 SH-4A core (160 MHz maximum) SH74572 SH-4A core (**240** MHz maximum)
1-9 1-15	• Figure 1.2 Pin Arrangement (Top Transparent View) • Table 1.3 Pin Functions of pin A6 Product A6 pin SH74562 Vcc SH74572 **Vss** Please refer to Appendix B.
14-1	• Table 14.1 Relation between Input Frequency and Input Clock • Figure 14.1 Block Diagram of CPG Product PLL frequency multiplier (input to CPU) SH74562 X8. SH74572 X**12**. Please refer to Appendix C.
14-1	• Table 14.1 Relation between Input Frequency and Input Clock Product CPU clock(MHz) SH74562 160. SH74572 **240** Please refer to Appendix C.
15-60	• Table 15.9 Minimum of Interrupt Response Time: Response time (Minimum) Product NMI IRQ Peripheral Module Remarks SH74562 40Icyc + S × Icyc 36Icyc + S × Icyc 32Icyc + S × Icyc When Icyc:Scyc: Pcyc = 4:2:1 SH74572 **55**Icyc + S × Icyc **49**Icyc + S × Icyc **43**Icyc + S × Icyc When Icyc:Scyc: Pcyc = **6**:2:1 Please refer to Appendix D.
38-1	• Table 38.1 Absolute Maximum Ratings Product Power dissipation (Pd) SH74562 1000 mW ,Ta = –40°C to +125°C SH74572 **1200** mW ,Ta = –40°C to +**105**°C Please refer to Appendix E.
38-1	• Table 38.1 Absolute Maximum Ratings Product Operating temperature (Topr) SH74562 –40°C to +125°C SH74572 –40°C to +**105**°C Please refer to Appendix E.

Page	Description
38-10	• Table 38.14 DC Characteristics - Supply Current Product Core supply current (Vdd power supply) SH74562 IDD is 480 mA(maximum) Ick = 160 MHz SH74572 IDD is **560** mA(maximum) Ick = **240** MHz Please refer to Appendix F.
38-11	• 38.3 AC Characteristics: Descriptions of the timing conditions Product The timing conditions of AC Characteristics SH74562 Ta = –40°C to +125°C SH74572 Ta = –40°C to +**105**°C Please refer to Appendix G.

Appendix A

Section 1 Overview

1.2 Product Line Overview

Table 1.2 lists the products.

Table 1.2 Products

Product	Model	ROM Capacity	RAM Capacity	Package	FlexRay
SH74552	R5F74552KBG	1 Mbyte	IL memory: 8 Kbytes, OL memory: 16 Kbytes, and SHwyRAM: 256 Kbytes	PRBG0176GA-A	Yes
SH74562	R5F74562KBG				No
SH74572	**R5F74572LBG**				**Yes**
SH74593	R5F74593LBG	1.5 Mbyte	IL memory: 8 Kbytes, OL memory: 16 Kbytes, and SHwyRAM: 512 Kbytes		Yes

Appendix B

Section 1 Overview

1.4 Pin Arrangement

Figure 1.2 shows the pin arrangement.

Position of pin A1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A	Vss (N.C.)	PG0/ MOSI0/ TO40	PF5/ SCL/ (CTX3)	PF1/ CTX0	DET3OR5	Vss	PL8/ TIA14/ IRQ7/ DREQ3	PL6/ TIA12/ (TIF1A)	PH15/ DROD7/ TO37/ DDC15	PH13/ DROD5/ (TO35)/ DDC13	PH9/ DROD1/ (TO31)/ DDC09/ CTS2#	PH5/ DROD13/ TO25/ DDC05/ TIA01	PH2/ DROD10/ TO22/ DDC02/ TIF1A	PH0/ DROD8/ TO20/ DDC00/ TIF0A	Vss (N.C.)	A
B	PG1/ MISO0/ TO41	PG2/ RSPCK0/ TO42	PG3/ TO43/ SSL00/ (IRQ7)	PF4/ SDA/ (CRX3)	PF0/ CRX0	ASEBRK#/ BRKACK	PL9/ TIA15/ AUDREVT#	PL5/ TIA11/ (TIF0B)	PL2/ DROWR	PH12/ DROD4/ TO34/ DDC12	PH8/ DROD0/ (TO30)/ DDC08/ RTS2#	PH4/ DROD12/ TO24/ DDC04/ TIA00	PH1/ DROD9/ TO21/ DDC01/ TIF0B	PH3/ DROD11/ TO23/ DDC03/ TIF1B	PK14/ AUDRSYN#	B
C	PG4/ IRQ2/ TO44/ SSL01	Vss	WDTOVF#	Vdd	Vdd	Vdd	PL4/ TIA10/ (TIF0A)	Vss	Vcc	PH14/ DROD6/ (TO36)/ DDC14/ IRQ1	PH10/ DROD2/ (TO32)/ DDC10	PH6/ DROD14/ TO26/ DDC06/ TIA02	PK12/ AUDRD3	PK13/ AUDRCLK	PK11/ AUDRD2	C
D	FWE	RESET#	Vss	Vss	Vdd	Vdd	PL3/ IRQ6	Vss	Vcc	PH11/ DROD3/ (TO33)/ DDC11	PH7/ DROD15/ (TO27)/ DDC07/ TIA03	PK8/ DREQ2	PK9/ AUDRD0/ RTS3#	PK10/ AUDRD1/ CTS3#	PK6/ TXD3	D
E	MD1	NMI	Vss	Vss								Vss	PK0/ IRQ5/ SSL10	PK5/ DINC4/ RXD3	PJ14/ TXD1/ MOSI1	E
F	XTAL	EXTAL	Vss	Vss								Vcc	PJ10/ RXD0/ PWMOFF4/ AD0TRG#	PJ15/ SCK1/ PSPCK1	PJ13/ RXD1/ MISO1	F
G	PLLVss	PLLVcc	MD0	MPMD								PJ1/ (CTX0)/ FTXA	PJ7/ CTX3/ TIF2B/ TXD2	PJ12/ SCK0/ TCLKB/ (IRQ0)	PJ11/ TXD0/ AD0END	G
H	TCK	TMS	MD2	TRST#								PJ0/ (CRX0)/ FRXA	PJ4/ CRX2/ FTXENA/ CTS0#	PJ6/ CRX3/ TIF2A/ RXD2/ TIA04	PJ5/ CTX2/ FTXENB/ SCK2	H
J	PD1/ PDIDATA1	TDO	TDI	Vss								PN1/ AD1IN1	PN0/ AD1IN0	PJ3/ CTX1/ FTXB/ RTS0#	PJ2/ CRX1/ FRXB	J
K	PD4/ PDIDATA4	PD3/ PDIDATA3	Vss	Vss								PN4/ AD1IN4	PN5/ AD1IN5	AVss	AVcc	K
L	PD8/ PDIDATA8	PD7/ PDIDATA7	Vcc	Vcc								PM0/ AD0IN0	AVss	AVREFL	AVREFH	L
M	PD9/ PDIDATA9	PD6/ PDIDATA6	PD0/ PDIDATA0	Vss	Vss	Vss	Vdd	Vdd	PC6/ CLKOUT/ TO36	Vcc	Vss	AVss	PM4/ AD0IN4	AVREFL	AVREFH	M
N	PD10/ PDIWR	PD5/ PDIDATA5	PA4/ TO04/ DDB04	PA7/ TO07/ DDB07	PA10/ TO12/ DDB10/ PSLDATA0	PA11/ TO13/ DDB11/ PSLDATA1	Vdd	Vdd	PC1/ TO31/ MISO2	Vcc	Vss	PM2/ AD0IN2	PM6/ AD0IN6	PM9/ AD0IN9	AVss	N
P	PD2/ PDIDATA2	PA3/ TO03/ DDB03	PA0/ TO00/ DDB00	PA2/ TO02/ DDB02	PA6/ TO06/ DDB06	PA9/ TO11/ DDB09/ PSLCLKA	PA13/ TO15/ DDB13/ PSLDATA3	PB1/ PWMOFF1/ DINB1	PC0/ TO30/ MOSI2/ (IRQ6)	PC3/ TO33/ SSL20/ IRQ0	PM15/ AD0IN15	PM13/ AD0IN13	PM11/ AD0IN11	PM8/ AD0IN8	AVcc	P
R	Vss (N.C.)	PE15/ TO27/ PSLCLR	PA1/ TO01/ DDB01	PA5/ TO05/ DDB05	PA8/ TO10/ DDB08/ PSLCLKB	PA12/ TO14/ DDB12/ PSLDATA2	PB0/ PWMOFF0/ DINB0	PB3/ PWMOFF3/ DINB3	PC2/ TO32/ RSPCK2/ DREQ0	PC5/ TO35	PC14	PM14/ AD0IN14	PM12/ AD0IN12	PM10/ AD0IN10	AVcc (N.C.)	R
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Figure 1.2 Pin Arrangement (Top Transparent View)

Appendix C

Section 14 Clock Generator (CPG)

14.1 Overview

Table 14.1 lists the relation between input frequency and input clock.

Table 14.1 Relation between Input Frequency and Input Clock

Input frequency (MHz)	PLL frequency multiplier (input to CPU)	CPU clock (MHz)	SHwy clock (MHz)	Peripheral clock (MHz)	Peripheral A clock (MHz)	FlexRay clock (MHz)
20	×12	240	80	40	80	80

Appendix D

Section15 Interrupt Controller (INTC)

15.5 Interrupt Response Time

Table 15.9 shows the interrupt response time, which is the interval from when an interrupt request occurs until the interrupt exception handling is started and the start instruction of the interrupt handling is fetched.

Table 15.9 Interrupt Response Time

Item		Number of State: NMI	Number of State: IRQ	Number of State: Peripheral Module	Remarks
Priority determination time		7 Pcyc	6 Pcyc	5Pcyc	
Wait time until the CPU finishes the current sequence			S-1 (≥ 0) × Icyc		
Interval from when interrupt exception handling begins (saving SR and PC) until a SHwy bus request is issued to fetch the start instruction of the interrupt handling			11Icyc + 1Scyc		
Response time	Total	(S + 10) Icyc + 1Scyc + 7 Pcyc	(S + 10) Icyc + 1Scyc + 6 Pcyc	(S + 10) Icyc + 1Scyc + 5Pcyc	
	Minimum	**55**Icyc + S × Icyc	**49**Icyc + S × Icyc	**43**Icyc + S × Icyc	When Icyc:Scyc: Pcyc = **6**:2:1

Legend:
Icyc: Period for one CPU clock cycle
Scyc: Period for one SHwy clock cycle
Pcyc: Period for one peripheral clock cycle
S: Number of instruction execution states

Appendix E

Section 38 Electrical Characteristics

38.1 Absolute Maximum Ratings

Table 38.1 shows the absolute maximum ratings.

Table 38.1 Absolute Maximum Ratings

Item		Symbol	Rating	Unit	Remarks
Power supply voltage	V_{dd}	Vdd	–0.3 to +2.0	V	
	Vcc, PLLVcc	Vcc	–0.3 to +6.5	V	
Input voltage	Vcc power supply related pins	Vin	–0.3 to Vcc +0.3	V	
Analog supply voltage		AVcc	–0.3 to +6.5	V	
Analog reference voltage		AVREFH	–0.3 to AVcc +0.3	V	AVREFH > AVREFL
		AVREFL	–0.3 to AVss +0.3	V	
Analog input voltage		VAN	–0.3 to AVcc +0.3	V	
Vss differential voltage		Vss – PLLVss	–0.1 to +0.1	V	
		Vss – AVss	–0.1 to +0.1	V	
		PLLVss – AVss	–0.1 to +0.1	V	
Maximum input current per pin*2 (per pin)	Digital input pins	Imax	–20 to +20	mA	
	Analog input pins	Imax	–20 to +20	mA	
Power dissipation		Pd	**1200**	mW	Ta = –40°C to +**105**°C
Operating temperature*1		topr	–40 to +**105**	°C	
Storage temperature		tstg	–55 to +125	°C	Before assembly

[Usage Notes]

Operating the MCU in excess of the absolute maximum ratings may result in permanent damage. Be sure to use the MCU in compliance with the connection of power pins, combination conditions of applicable power supply voltages, voltage applicable to each pin, and conditions of output voltage, as specified in the manual. Connecting a non-specified power supply or using the MCU at an incorrect voltage may result in permanent damage of the MCU or the system that contains the MCU.

Notes: *1 This does not guarantee that the microcomputer can operate continuously at 85°C-plus. Consult Renesas if the microcomputer is going to be used for 85°C-plus applications.

*2 Ensure that the current input duration does not exceed 10 ms and that the total current input does not exceed 100 mA.

Appendix F

Section 38 Electrical Characteristics

Table 38.14DC Characteristics - Supply Current

Recommended Operating Conditions: Vcc = PLLVcc = 5.0 V ±0.5 V/3.3 V ±0.3 V, AVcc = 5.0 V ±0.5 V/3.3 V ±0.3 V

Item		Symbol	Min.	Typ.	Max.	Unit	Measurement Conditions
Core supply current (Vdd power supply)		I_{DD}	—	—	**560**	mA	Ick = **240** MHz
System consumption current (Vcc power supply)*1 (Including flash memory programming and erasure)		I_{CC}	—	—	90	mA	Pck = 40 MHz
PLL supply current (PLLVcc power supply)		I_{PLL}	—	—	10	mA	
Analog supply current (AVcc power supply)	During A/D conversion	I_{AVcc}	—	—	10	mA	2 modules, Pck = 40MHz
	Awaiting A/D conversion		—	—	1	mA	
ADC reference power supply current (AVREF)	During A/D conversion	I_{AVREF}	—	—	4	mA	2 modules, Pck = 40MHz
	Awaiting A/D conversion		—	—	3.5	mA	

Notes: *1 An inrush current of about 100 mA will be caused at power on.

- When the A/D converter is not used, do not leave the AVcc, AVref, and AVss pins open.
- The supply current is measured when V_{IH}min = Vcc – 0.5 V, V_{IL} = 0.5 V, with all output pins unloaded.

Appendix G

Section 38 Electrical Characteristics

38.3 AC Characteristics

- The timing conditions without specifications are the following :
  Vdd = 1.5 V + 0.15 V, -0.1 V, Vcc = PLLVcc = 5.0 V ±0.5 V/3.3 V ±0.3 V, AVcc = 5.0 V ±0.5 V/3.3 V ±0.3 V, AVREFH = 4.5 V to AVcc/3.0 V to AVcc,
  Vss = PLLVss = AVss = AVREFL = 0 V, Ta = -40°C to +**105**°C
  When not otherwise specified, the input threshold value is the value under conditions where all module input pins for the same channel are set to the same characteristics. When not otherwise specified, the output driving ability is the value under conditions where all module output pins for the same channel are set to the same characteristics.
- Standard values are guaranteed when the output load capacity of the measurement pin is 15 pF to 50 pF. Note that the output load capacity of the CLKOUT pin is 15pF to 30pF.

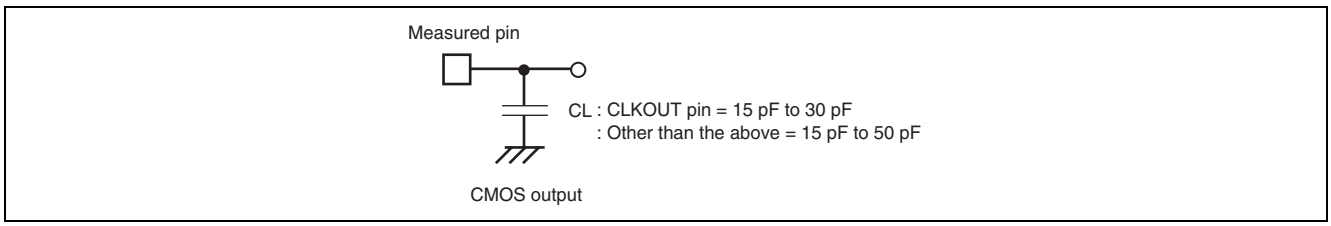

Figure 38.1 Measurement Circuit for Output Switching Characteristics

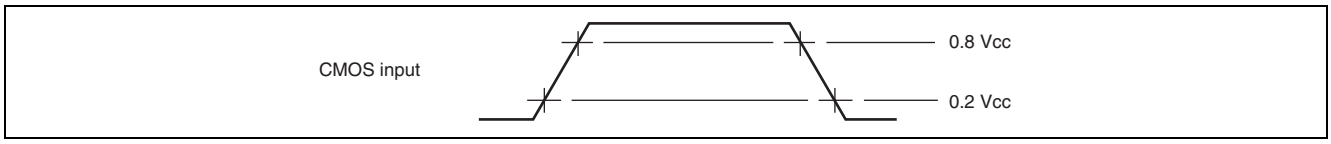

Figure 38.2 Input Waveform and Timing Check Points at Characteristics Measurement

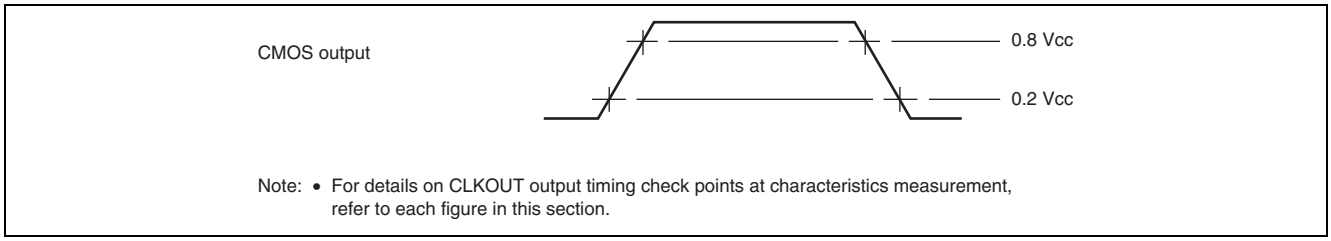

Figure 38.3 Output Timing Check Points at Characteristics Measurement

REVISION HISTORY	SH74572 Datasheet

Rev.	Date	Description	
		Page	Summary
1.10	Oct 26, 2011	-	First edition issued
1.20	Sep 10, 2012	Throughout Datasheet	Document number added
		1	1. Overview: Description changed. From: the SH7457 Group is the same as the SH7455 Group. To : the SH7457 Group is the same as the SH7456 Group.
			Table 1.1 Products: SH7459 Group added.
			Table 2.1 : Title and description changed. From: Difference between SH74552 and SH74572 To : Difference between SH74562 and SH74572
		4	Appendix A Table 1.2 Products: SH7459 Group added.
		Last Page	The following items added - General Precautions in the Handing of MPU/MCU Products - Notice

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 manual, refer to the relevant sections of the manual. If the descriptions under General Precautions in the Handling of MPU/MCU Products and in the body of the manual differ from each other, the description in the body of the manual takes precedence.

1. Handling of Unused Pins

   Handle unused pins in accord 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 one with a different part number, confirm that the change will not lead to problems.

   — The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

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.

RENESAS

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: +44-1628-585-100, Fax: +44-1628-585-900

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 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd., Pudong District, Shanghai 200120, China
Tel: +86-21-5877-1818, Fax: +86-21-6887-7858 / -7898

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.
1 harbourFront Avenue, #06-10, keppel Bay Tower, Singapore 098632
Tel: +65-6213-0200, Fax: +65-6278-8001

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.
11F., Samik Lavied' or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

Colophon 2.0