

DESCRIPTION

R8A66160 is a LED array driver having a 16-bit serial input and parallel output shift register function with direct coupled reset input and output latch function.

This product guarantees the output current of 24mA ($V_{CC} = 5V$ case) which is sufficient for cathode common LED drive, capable of following 16-bits continuously at the same time. Parallel output is open drain output. In addition, as this product has been designed in complete CMOS, power consumption can be greatly reduced when compared with conventional BIPOLAR or Bi-CMOS products. Furthermore, pin layout ensures the realization of an easy printed circuit. R8A66160 is the succession product of M66310.

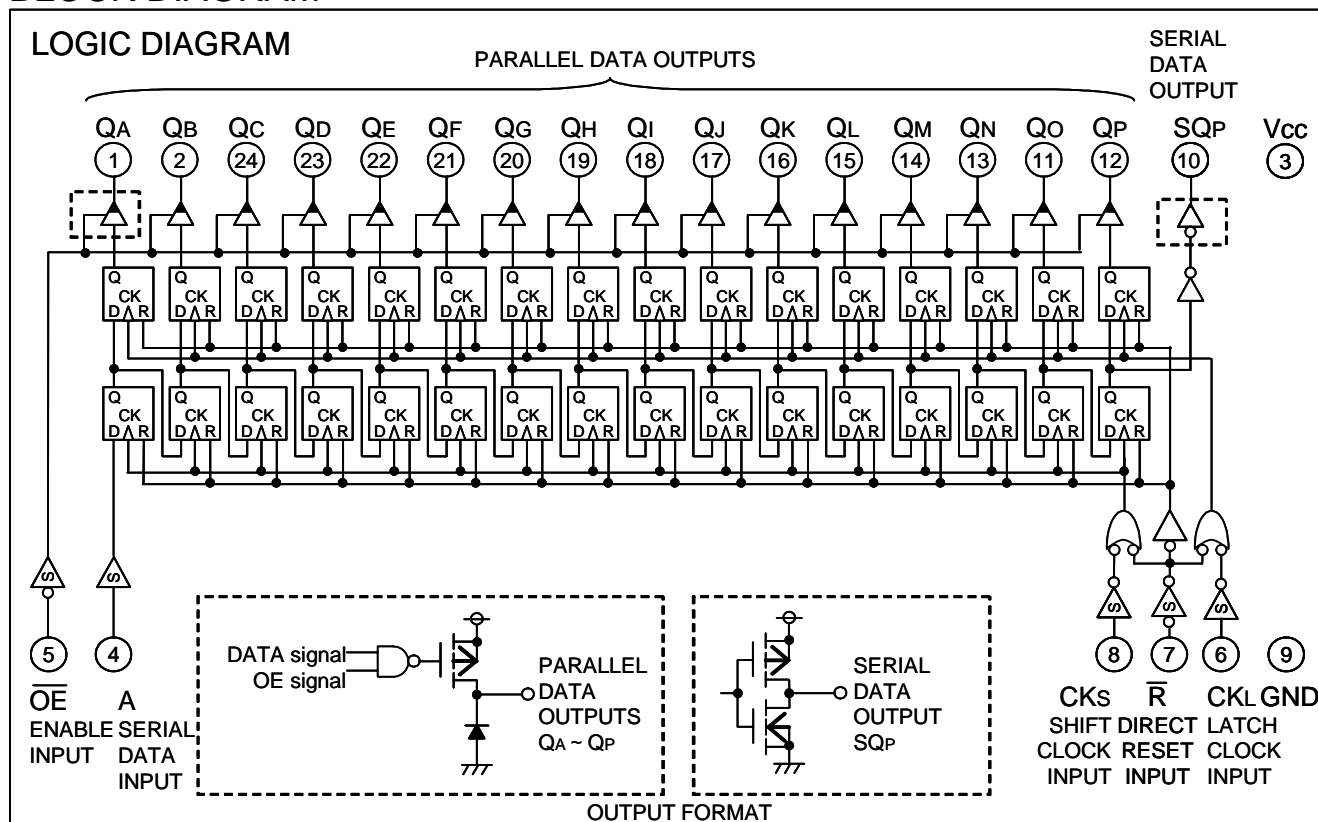
FEATURES

- Cathode common LED drive
- V_{CC} 5V or 3.3V single power supply
- High output current: all parallel outputs $Q_A \sim Q_P$ $I_{OH} = -24mA$ (at $V_{CC} = 5.0V$) $I_{OH} = -12mA$ (at $V_{CC} = 3.3V$) simultaneous lighting available
- Low power dissipation: 100uW/package (max) ($V_{CC} = 5.0V$, $T_a = 25^\circ C$, quiescent state)
- High noise margin: Schmitt input circuit provides responsiveness to a long line length
- Equipped with direct-coupled reset
- Open drain output: (except serial data output SQP)
- Wide operating temperature range: $T_a = -40^\circ C \sim +85^\circ C$
- Pin layout facilitates printed circuit wiring. (This layout facilitates cascade connection and LED connection)

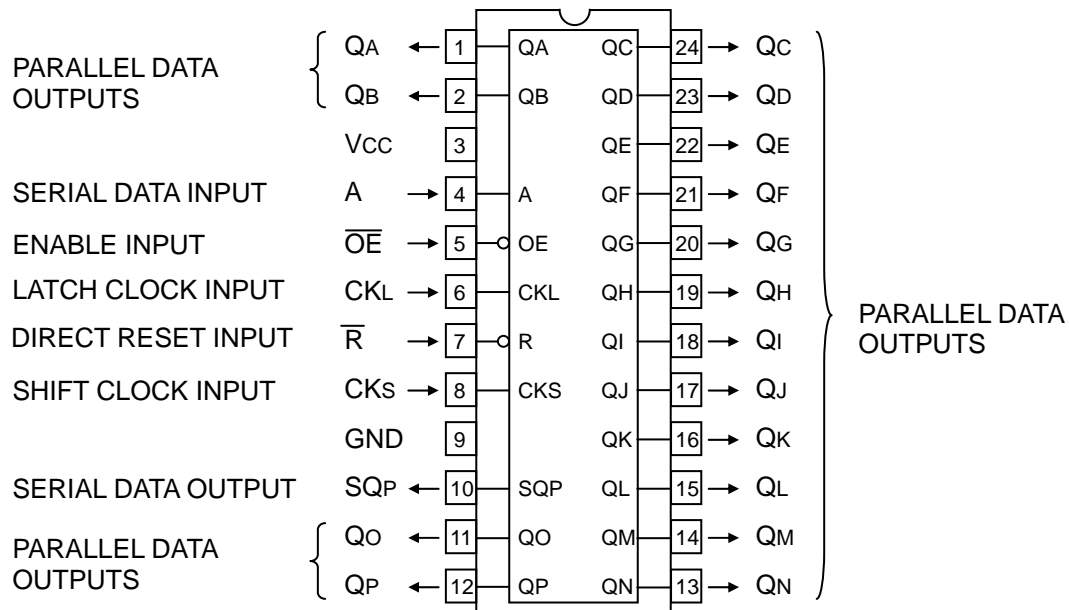
APPLICATION

- LED array drive, The various LED display modules
- PPC, Printer, VCR, Mini-compo, Button-Telephone etc. All of LED display equipment

BLOCK DIAGRAM



PIN CONFIGURATION (TOP VIEW)



FUNCTIONAL DESCRIPTION

As R8A66160 uses silicon gate CMOS process. It realizes high-speed and high-output currents sufficient for LED drive while maintaining low power consumption and allowance for high noises.

Each bit of a shift register consists of two flip-flop having independent clocks for shifting and latching.

As for clock input, shift clock input CKs and latch clock input CKL are independent from each other, shift and latch operations being made when "L" changes to "H".

Serial data input A is the data input of the first-step shift register and the signal of A shifts shifting registers one by one when a pulse is impressed to CKs. When A is "L", the signal of "L" shifts.

When the pulse is impressed to CKL, the contents of the shifting register at that time are stored in a latching register, and they appear in the parallel data outputs from QA ~ QP.

Outputs QA ~ QP are open drain outputs.

To extend the number of bits, use the serial data output SQR which shows the output of the shifting register of the 16th bit.

When reset input R is changed to "L", QA ~ QP and SQR are reset. In this case, shifting and latching register are reset.

If "H" is impressed to output enable input OE, QA ~ QP reaches the high impedance state, but SQR does not reach the high impedance state. Furthermore, change in OE does not affect shift operation.

FUNCTION TABLE (Note: 1)

Operation mode		Input					Parallel data output																Serial data output SQR	Remarks
		R	CKs	CKL	A	OE	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP		
Reset		L	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	L	—
Shift Latch operation	Shift t1	H		X	H	L	QA ⁰	QB ⁰	QC ⁰	QD ⁰	QE ⁰	QF ⁰	QG ⁰	QH ⁰	QI ⁰	QJ ⁰	QK ⁰	QL ⁰	QM ⁰	QN ⁰	QO ⁰	QP ⁰	q0 ⁰	Output lighting "H"
	Latch t2	H	X		X	L	H	qA ⁰	qB ⁰	qC ⁰	qD ⁰	qE ⁰	qF ⁰	qG ⁰	qH ⁰	qI ⁰	qJ ⁰	qK ⁰	qL ⁰	qM ⁰	qN ⁰	qO ⁰	qP ⁰	
	Shift t1	H		X	L	L	QA ⁰	QB ⁰	QC ⁰	QD ⁰	QE ⁰	QF ⁰	QG ⁰	QH ⁰	QI ⁰	QJ ⁰	QK ⁰	QL ⁰	QM ⁰	QN ⁰	QO ⁰	QP ⁰	q0 ⁰	Output lights-out "L"
	Latch t2	H	X		X	L	Z	qA ⁰	qB ⁰	qC ⁰	qD ⁰	qE ⁰	qF ⁰	qG ⁰	qH ⁰	qI ⁰	qJ ⁰	qK ⁰	qL ⁰	qM ⁰	qN ⁰	qO ⁰	qP ⁰	
Output disable		X	X	X	X	H	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	qP	—

Note1: : Change from low-level to high-level

Q⁰ : Output state Q before CKL changed

X : Irrelevant

q⁰ : Contents of shift register before CKs changed

q : Contents of shift register

t₁, t₂ : t₂ is set after t₁ is set

Z : High Impedance

ABSOLUTE MAXIMUM RATINGS (Ta=-40~+85°C, unless otherwise noted)

Symbol	Parameter		Conditions	Ratings	Unit
VCC	Supply voltage			-0.5 ~ +7.0	V
VI	Input voltage			-0.5 ~ VCC+0.5	V
VO	Output voltage			-0.5 ~ VCC+0.5	V
IO	Output current per output pin	QA ~ QP		-50	mA
		SQP		±25	
ICC	Supply / GND current		VCC, GND	-410, +20	mA
Pd	Power dissipation		(Note 2)	500	mW
Tstg	Storage temperature range			-65 ~ +150	°C

Note 2: R8A66160SP; Ta=-40~+70°C, Ta=+70~+85°C are derated at -6mW/°C.

RECOMMENDED OPERATING CONDITIONS (Ta=-40~+85°C, unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min.	Typ.	Max.	
VCC	Supply voltage	5.0V support	4.5	5.0	5.5	V
		3.3V support	3.0	3.3	3.6	V
VI	Input voltage		0		VCC	V
VO	Output voltage		0		VCC	V
Topr	Operating temperature range		-40		+85	°C

ELECTRICAL CHARACTERISTICS

■5.0V version support specifications (Ta=-40~+85°C, Vcc=4.5V~5.5V, unless otherwise noted)

Symbol	Parameter		Test conditions		Limits			Unit
					Min.	Typ.	Max.	
VT+	Positive-going threshold voltage		VO=0.1V, VCC=0.1V IO =20uA		0.35xVCC		0.70xVCC	V
VT-	Negative-going threshold voltage		VO=0.1V, VCC=0.1V IO =20uA		0.20xVCC		0.55xVCC	V
VOH	High-level output voltage	QA ~ QP	VI=VT+, VT- VCC=4.5V (Note3)	IOH= -20uA	VCC-0.1			V
				IOH= -24mA	3.66			
				IOH= -40mA	3.25			
VOH	High-level output voltage	SQP	VI=VT+, VT- VCC=4.5V	IOH= -20uA	VCC-0.1			V
				IOH= -4mA	3.66			
VOL	Low-level output voltage	SQP	VI=VT+, VT- VCC=4.5V	IOL= 20uA			0.10	V
				IOL= 4mA			0.53	
IIH	High-level input current		VI=VCC, VCC=5.5V				5	uA
IIL	Low-level input current		VI=GND, VCC=5.5V				-5	uA
IO	Maximum output leakage current	QA ~ QP	VI=VT+, VT- VCC=5.5V	VO=VCC			10	uA
				VO=GND			-10	
ICC	Quiescent supply current		VI=VCC,GND, VCC=5.5V				200	uA

Note 3: R8A66160 is used under the condition of an output current IOH=-40mA, the number of simultaneous drive outputs is restricted as shown in the Duty Cycle – IOH of TYPICAL CHARACTERISTICS.

■3.3V version support specifications (Ta=-40~+85°C, Vcc=3.0V~3.6V, unless otherwise noted)

Symbol	Parameter		Test conditions		Limits			Unit
					Min.	Typ.	Max.	
VT+	Positive-going threshold voltage		VO=0.1V, VCC=0.1V IO =20uA		0.35xVCC		0.70xVCC	V
VT-	Negative-going threshold voltage		VO=0.1V, VCC=0.1V IO =20uA		0.20xVCC		0.55xVCC	V
VOH	High-level output voltage	QA ~ QP	VI=VT+, VT- VCC=3.0V	IOH= -20uA	VCC-0.1			V
				IOH= -12mA	2.34			
				IOH= -20mA	2.08			
VOH	High-level output voltage	SQP	VI=VT+, VT- VCC=3.0V	IOH= -20uA	VCC-0.1			V
				IOH= -2mA	2.60			
VOL	Low-level output voltage	SQP	VI=VT+, VT- VCC=3.0V	IOL= 20uA			0.10	V
				IOL= 2mA			0.40	
IIH	High-level input current		VI=VCC, VCC=3.6V				5	uA
IIL	Low-level input current		VI=GND, VCC=3.6V				-5	uA
IO	Maximum output leakage current	QA ~ QP	VI=VT+, VT- VCC=3.6V	VO=VCC			10	uA
				VO=GND			-10	
ICC	Quiescent supply current		VI=VCC,GND, VCC=3.6V				200	uA

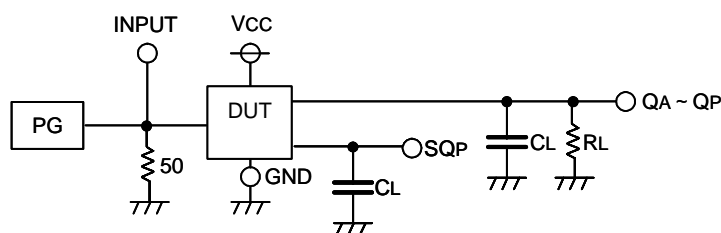
SWITCHING CHARACTERISTICS (Ta=-40~+85°C, Vcc=5.0V or 3.3V)

Symbol	Parameter		Test conditions	5.0V specification			3.3V specification			Unit
				Min.	Typ.	Max.	Min.	Typ.	Max.	
fmax	Maximum clock frequency		CL=50pF RL=1KΩ (Note 4)			4			3.3	MHz
tPLH	Output "L"-"H" and "H"-"L" propagation time	CKS - SQP				125			150	ns
tPHL		CKS - SQP				125			150	ns
tPHL	Output "H"-"L" propagation time	\overline{R} - SQP				125			150	ns
tPHZ	Output "H"-"Z" propagation time	\overline{R} - QA ~ QP (turned off)				200			220	ns
tPZH	Output "Z"-"H" propagation time	CKL - QA ~ QP (turned on)				125			150	ns
tPHZ	Output "H"-"Z" propagation time	CKL - QA ~ QP (turned off)				200			220	ns
tPZH	Output "Z"-"H" propagation time	\overline{OE} - QA ~ QP (turned on)				125			150	ns
tPHZ	Output "H"-"Z" propagation time	\overline{OE} - QA ~ QP (turned off)				200			220	ns
CI	Input capacitance					10			10	pF

TIMING REQUIREMENTS (Ta=-40~+85°C, Vcc=5.0V or 3.3V)

Symbol	Parameter	Test conditions	5.0V specification			3.3V specification			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
tw	CKS, CKL, \overline{R} pulse width	(Note 4)	125			150			ns
tsu	A setup time with respect to CKS		125			150			ns
tsu	CKS setup time with respect to CKL		125			150			ns
th	A hold time with respect to CKS		15			20			ns
trec	\overline{R} recovery time with respect to CKS, CKL		70			80			ns

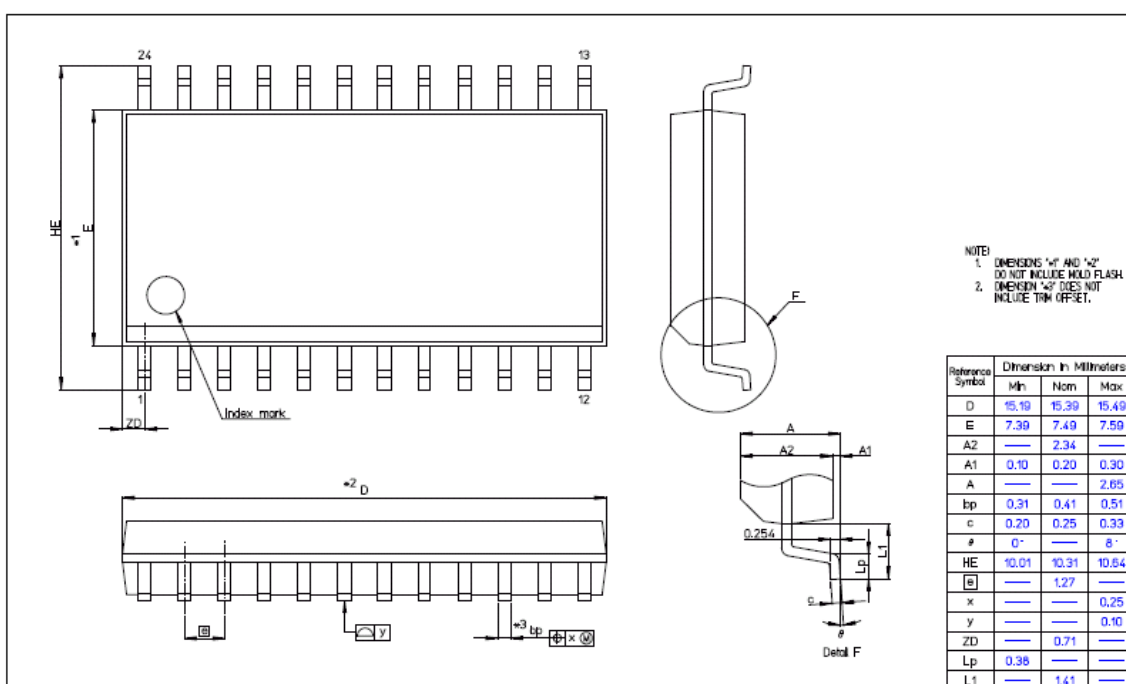
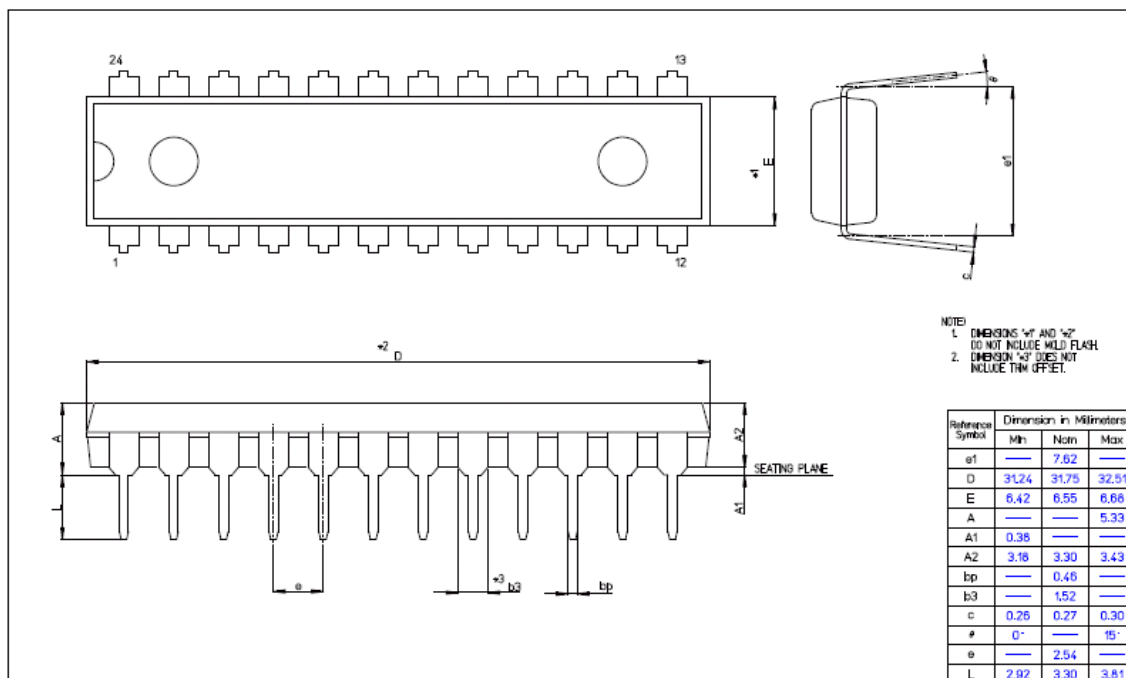
Note4 : Test Circuit



- (1) The pulse generator (PG) has the following characteristics (10%~90%) : tr=6ns,tf=6ns
- (2) The capacitance CL includes stray wiring capacitance and the probe input capacitance.

PACKAGE OUTLINE

Product name	Package	RENESAS Code	Previous Code
R8A66160DD	24pin DIP	PRDP0024AF-A	24P4X-A
R8A66160SP	24pin SOP	PRSP0024DF-A	24P2X-B



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

Notes:

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
 - (1) artificial life support devices or systems
 - (2) surgical implantations
 - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
 - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas 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 applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



RENESAS SALES OFFICES

<http://www.renesas.com>

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

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2377-3473

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology 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: <603> 7955-9390, Fax: <603> 7955-9510