R1LV0816ABG -5SI, 7SI

8Mb Advanced LPSRAM (512k word x 16bit)

REJ03C0393-0100
Rev.1.00
2009.12.08

Description

The R1LV0816ABG is a family of low voltage 8-Mbit static RAMs organized as 524,288-words by 16-bit, fabricated by Renesas's high-performance 0.15um CMOS and TFT technologies.

The R1LV0816ABG is suitable for memory applications where a simple interfacing, battery operating and battery backup are the important design objectives.

The R1LV0816ABG is packaged in a 48balls fine pitch ball grid array [f-BGA / 7.5 mm×8.5mm with the ball-pitch of 0.75mm and 6x8 array]. It gives the best solution for a compaction of mounting area as well as flexibility of wiring pattern of printed circuit boards.

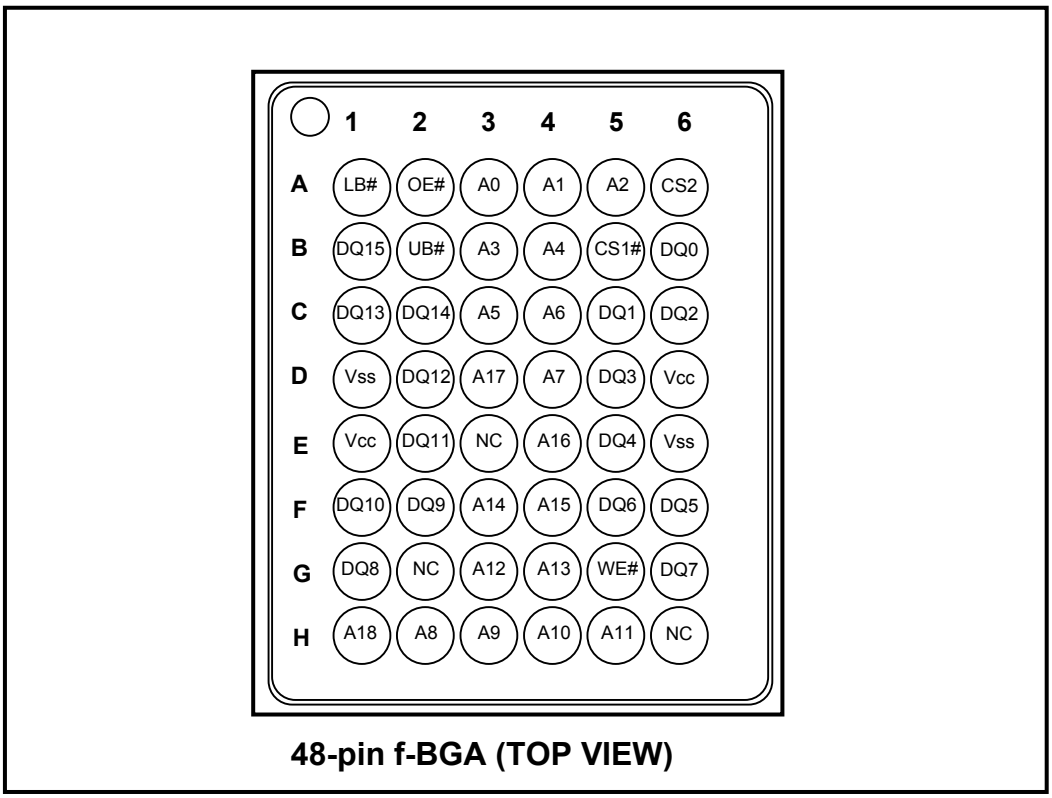
Features

- Single 2.4-3.6V power supply
- Small stand-by current: 1.2µA (Vcc=3.0V, typ.)
- No clocks, No refresh
- All inputs and outputs are TTL compatible
- Easy memory expansion by CS1#, CS2, LB# and UB#
- Common Data I/O
- Three-state outputs: OR-tie capability
- OE# prevents data contention in the I/O bus
- Operation temperature: -40 ~ +85°C

Ordering information

Type No.	Power supply	Access time	Temperature Range	Package
R1LV0816ABG-5SI	2.7V to 3.6V	55 ns	-40 ~ +85°C	48-ball fBGA with 0.75mm ball pitch PTBG0048HB-A(48FHH)
	2.4V to 2.7V	70 ns		
R1LV0816ABG-7SI	2.4V to 3.6V	70 ns		

Pin Arrangement

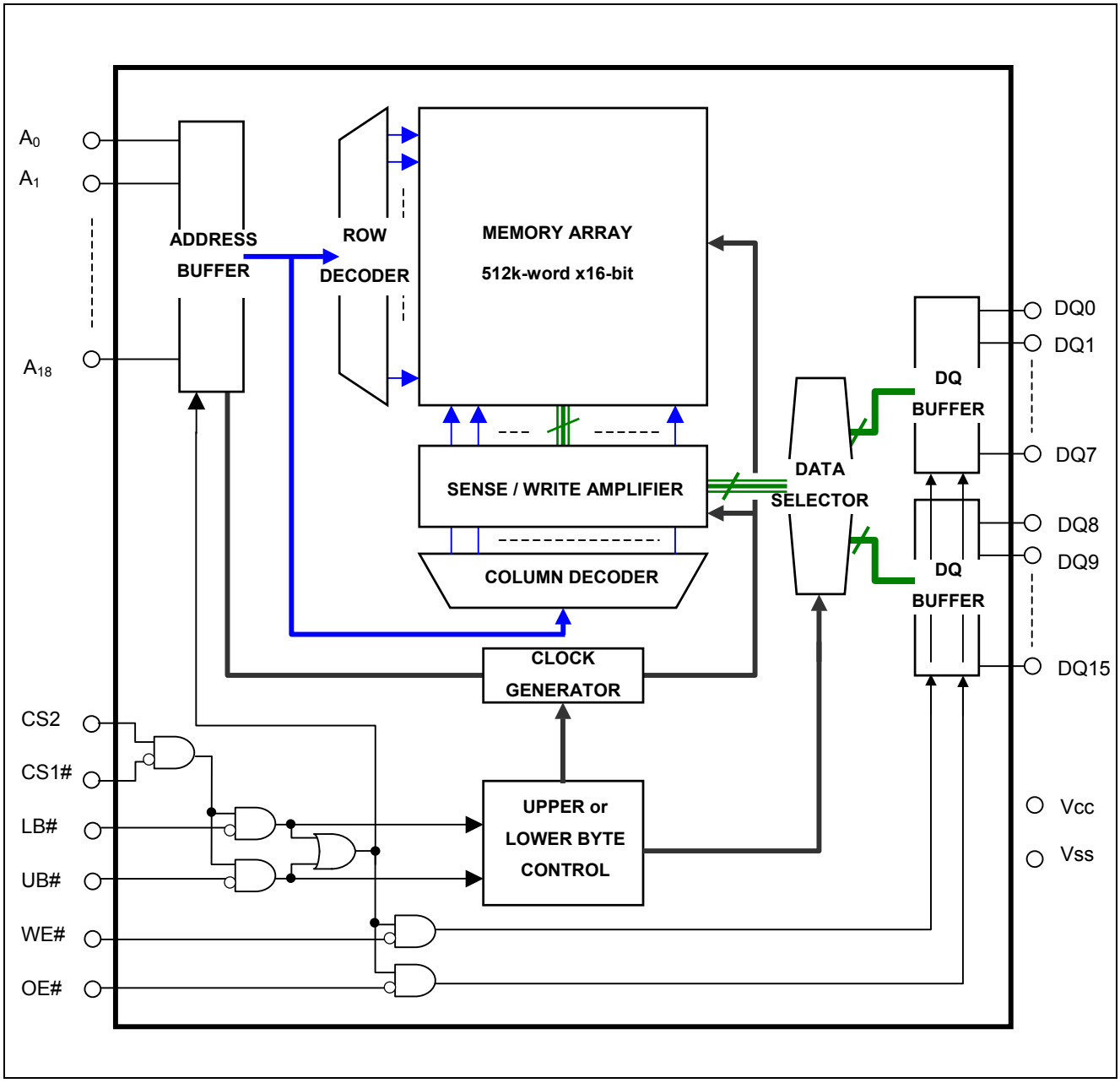


48-pin f-BGA (TOP VIEW)

Pin Description

Pin name	Function
Vcc	Power supply
Vss	Ground
A0 to A18	Address input
DQ0 to DQ15	Data input/output
CS1#	Chip select 1
CS2	Chip select 2
WE#	Write enable
OE#	Output enable
LB#	Lower byte enable
UB#	Upper byte enable
NC	Non connection

Block Diagram



Operation Table

CS1#	CS2	LB#	UB#	WE#	OE#	DQ0~7	DQ8~15	Operation
H	X	X	X	X	X	High-Z	High-Z	Stand-by
X	L	X	X	X	X	High-Z	High-Z	Stand-by
X	X	H	H	X	X	High-Z	High-Z	Stand-by
L	H	L	H	L	X	Din	High-Z	Write in lower byte
L	H	L	H	H	L	Dout	High-Z	Read in lower byte
L	H	L	H	H	H	High-Z	High-Z	Output disable
L	H	H	L	L	X	High-Z	Din	Write in upper byte
L	H	H	L	H	L	High-Z	Dout	Read in upper byte
L	H	H	L	H	H	High-Z	High-Z	Output disable
L	H	L	L	L	X	Din	Din	Word write
L	H	L	L	H	L	Dout	Dout	Word read
L	H	L	L	H	H	High-Z	High-Z	Output disable

Note 1. H: V_{IH} L:V_{IL} X: V_{IH} or V_{IL}

Absolute Maximum Ratings

Parameter	Symbol	Value	unit
Power supply voltage relative to Vss	Vcc	-0.5 to +4.6	V
Terminal voltage on any pin relative to Vss	V_T	-0.5[*1] to Vcc+0.3[*2]	V
Power dissipation	P_T	0.7	W
Operation temperature	Topr	-40 to +85	°C
Storage temperature range	Tstg	-65 to 150	°C
Storage temperature range under bias	Tbias	-40 to +85	°C

Note 1. -3.0V in case of AC (Pulse width ≤30ns)
2. Maximum voltage is +4.6V

Recommend Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Supply voltage	Vcc	2.4	3.0	3.6	V	-	
	Vss	0	0	0	V	-	
Input high voltage	V_{IH}	2.0	-	Vcc+0.2	V	Vcc=2.4V to 2.7V	
		2.2	-	Vcc+0.2	V	Vcc=2.7V to 3.6V	
Input low voltage	V_{IL}	-0.2	-	0.4	V	Vcc=2.4V to 2.7V	1
		-0.2	-	0.6	V	Vcc=2.7V to 3.6V	1
Ambient temperature range	Ta	-40	-	+85	°C	-	

Note 1. -3.0V in case of AC (Pulse width ≤30ns)

DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	
Input leakage current	$\lvert I_{LI} \rvert$	-	-	1	µA	Vin = Vss to Vcc	
Output leakage current	$\lvert I_{LO} \rvert$	-	-	1	µA	CS1# =V_{IH} or CS2 =V_{IL} or OE# =V_{IH} or WE# =V_{IL} or LB# = UB# =V_{IH}, VI/O =Vss to Vcc	
Average operating current	I_{CC1}	-	20*1	35	mA	Min. cycle, duty =100%, II/O = 0mA CS1# =V_{IL}, CS2 =V_{IH}, Others = V_{IH}/V_{IL}	
	I_{CC2}	-	2*1	5	mA	Cycle =1□s, duty =100%, II/O = 0mA CS1# ≤ 0.2V, CS2 ≥ V_{CC}-0.2V, V_{IH} ≥ V_{CC}-0.2V, V_{IL} ≤ 0.2V	
Standby current	I_{SB}	-	0.1*1	0.3	mA	CS2 =V_{IL}	
Standby current	I_{SB1}	-	1.2*1	4	µA	~+25°C	Vin ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS1# ≥ V_{CC}-0.2V, CS2 ≥ V_{CC}-0.2V or (3) LB# = UB# ≥ V_{CC}-0.2V, CS1# ≤ 0.2V, CS2 ≥ V_{CC}-0.2V
		-	3*2	6	µA	~+40°C	
		-	-	15	µA	~+70°C	
		-	-	20	µA	~+85°C	
Output high voltage	V_{OH}	2.4	-	-	V	I_{OH} = -1mA Vcc≥2.7V	
	V_{OH2}	2.0	-	-	V	I_{OH} = -0.1mA	
Output low voltage	V_{OL}	-	-	0.4	V	I_{OL} = 2mA Vcc≥2.7V	
	V_{OL2}	-	-	0.4	V	I_{OL} = 0.1mA	

Note 1.Typical parameter indicates the value for the center of distribution at 3.0V(Ta=+25°C), and not 100% tested.
2.Typical parameter indicates the value for the center of distribution at 3.0V(Ta=+40°C), and not 100% tested.

Capacitance

(Ta =25°C, f =1MHz)

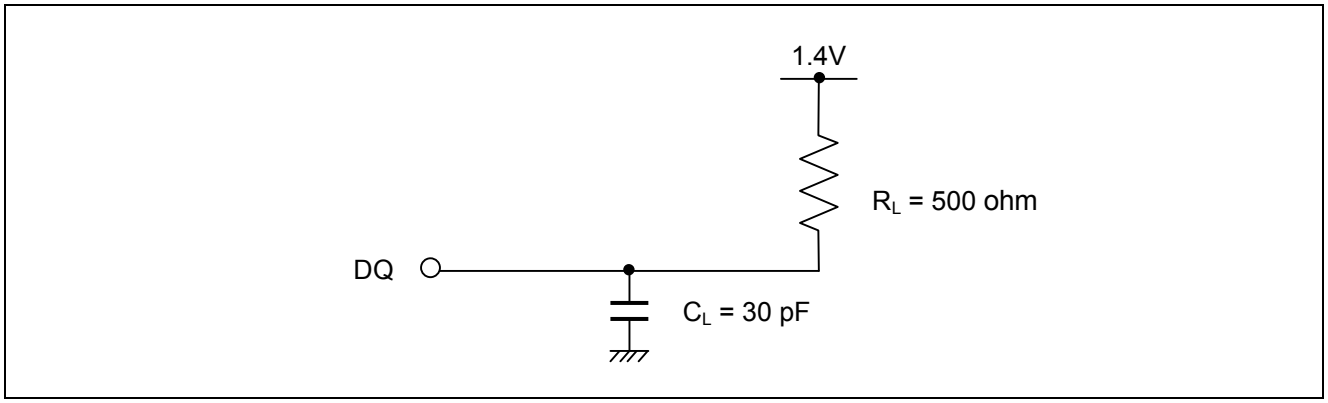
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions	Note
Input capacitance	C in	-	-	10	pF	Vin =0V	1
Input / output capacitance	$C_{I/O}$	-	-	10	pF	$V_{I/O}$ =0V	1

Note 1.Typical parameter is sampled and not 100% tested.

AC Characteristics

Test Conditions (Vcc = 2.4V ~ 3.6V, Ta = -40 ~ +85°C)

- Input pulse levels: VIL = 0.4V, VIH = 2.4V (Vcc = 2.7V ~ 3.6 V)
  VIL = 0.4V, VIH = 2.2V (Vcc = 2.4V ~ 2.7 V)
- Input rise and fall times: 5ns
- Input and output timing reference level: 1.4V
- Output load: See figures (Including scope and jig)



Read cycle

Parameter	Symbol	R1LV0816ABG-5SI (Note 0)		R1LV0816ABG-7SI		Unit	Note
		Min.	Max.	Min.	Max.		
Read cycle time	t_{RC}	55	-	70	-	ns	
Address access time	t_{AA}	-	55	-	70	ns	
Chip select access time	t_{ACS1}	-	55	-	70	ns	
	t_{ACS2}	-	55	-	70	ns	
Output enable to output valid	t_{OE}	-	30	-	35	ns	
Output hold from address change	t_{OH}	10	-	10	-	ns	
LB#, UB# access time	t_{BA}	-	55	-	70	ns	
Chip select to output in low-Z	t_{CLZ1}	10	-	10	-	ns	2,3
	t_{CLZ2}	10	-	10	-	ns	2,3
LB#, UB# enable to low-Z	t_{BLZ}	5	-	5	-	ns	2,3
Output enable to output in low-Z	t_{OLZ}	5	-	5	-	ns	2,3
Chip deselect to output in high-Z	t_{CHZ1}	0	20	0	25	ns	1,2,3
	t_{CHZ2}	0	20	0	25	ns	1,2,3
LB#, UB# disable to high-Z	t_{BHZ}	0	20	0	25	ns	1,2,3
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1,2,3

Write Cycle

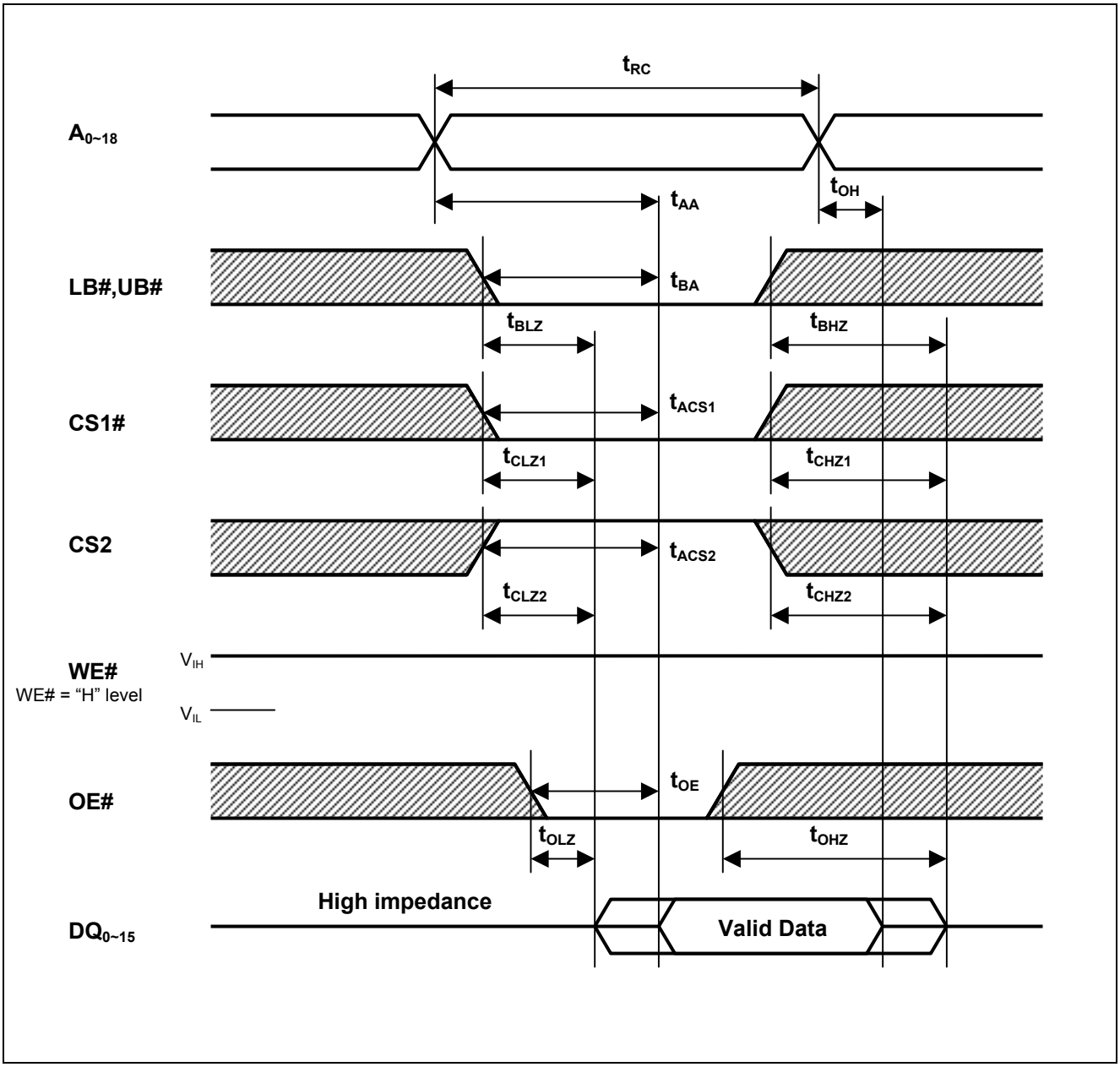
Parameter	Symbol	R1LV0816ABG-5SI (Note 0)		R1LV0816ABG-7SI		Unit	Note
		Min.	Max.	Min.	Max.		
Write cycle time	t_{WC}	55	-	70	-	ns	
Address valid to end of write	t_{AW}	50	-	65	-	ns	
Chip select to end of write	t_{CW}	50	-	65	-	ns	5
Write pulse width	t_{WP}	40	-	55	-	ns	4
LB#, UB# valid to end of write	t_{BW}	50	-	65	-	ns	
Address setup time	t_{AS}	0	-	0	-	ns	6
Write recovery time	t_{WR}	0	-	0	-	ns	7
Data to write time overlap	t_{DW}	25	-	35	-	ns	
Data hold from write time	t_{DH}	0	-	0	-	ns	
Output enable from end of write	t_{OW}	5	-	5	-	ns	2
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1,2
Write to output in high-Z	t_{WHZ}	0	20	0	25	ns	1,2

Note 0. If Vcc is 2.4-2.7V, parameters of R1LV0816ABG-7SI (70ns) are applied.

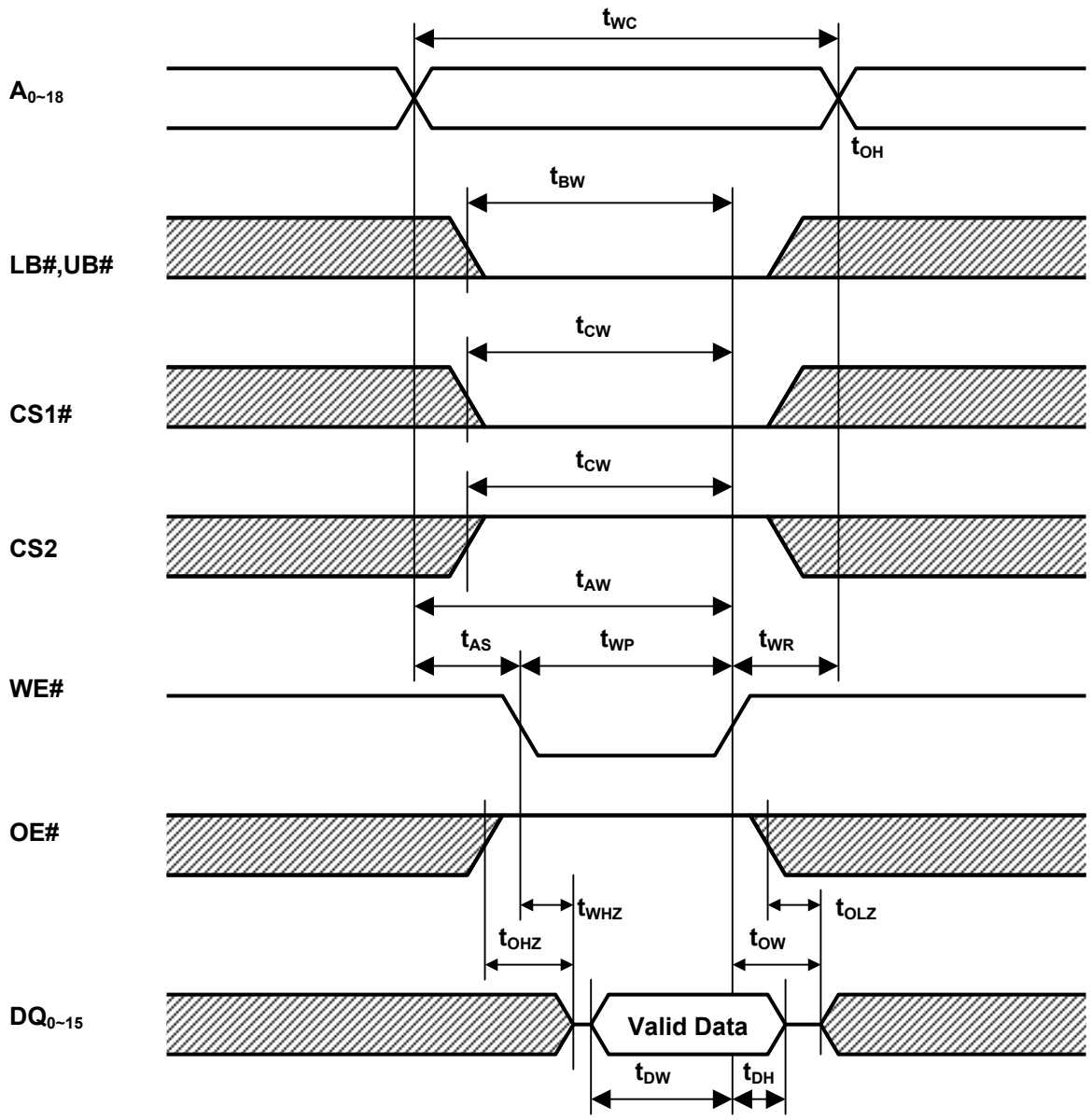
1. t_{CHZ}, t_{OHZ}, t_{WHZ} and t_{BHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.
2. Typical parameter is sampled and not 100% tested.
3. At any given temperature and voltage condition, t_{HZ} max is less than t_{LZ} min both for given device and from device to device.
4. A write occurs during the overlap of a low CS1#, a high CS2, a low WE# and a low LB# or low UB#.
   A write begins at the latest transitions among CS1# going low, CS2 going high, WE# going low and LB# going low or UB# going low.
   A write ends at the earliest transitions among CS1# going high, CS2 going low, WE# going high and LB# going high or UB# going high. t_{WP} is measured from the beginning of write to the end of write.
5. t_{CW} is measured from the later of CS1# going low or CS2 going high to the end of write.
6. t_{AS} is measured the address valid to the beginning of write.
7. t_{WR} is measured from the earliest of CS1# or WE# going high or CS2 going low to the end of write cycle

Timing Waveforms

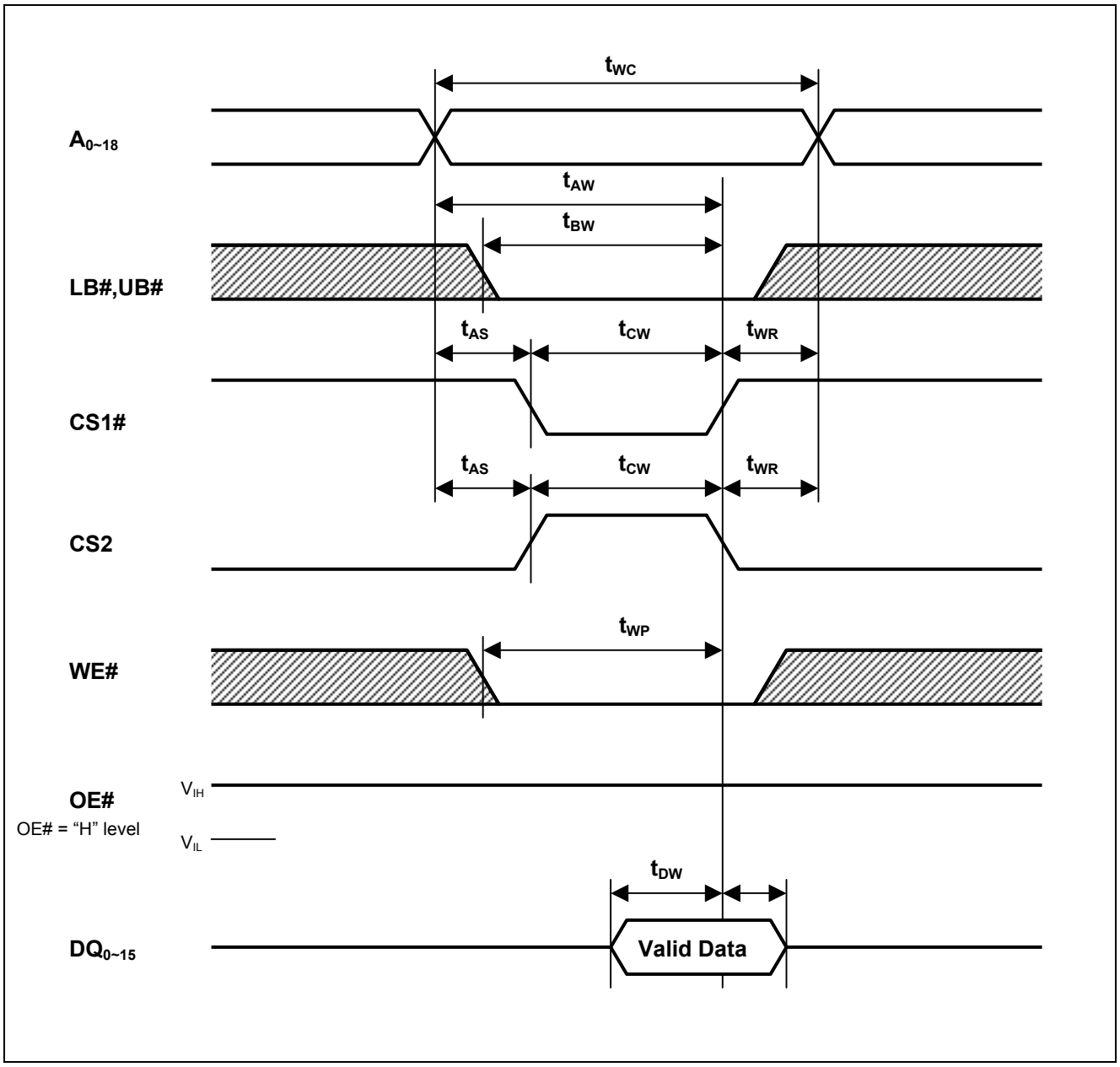
Read Cycle



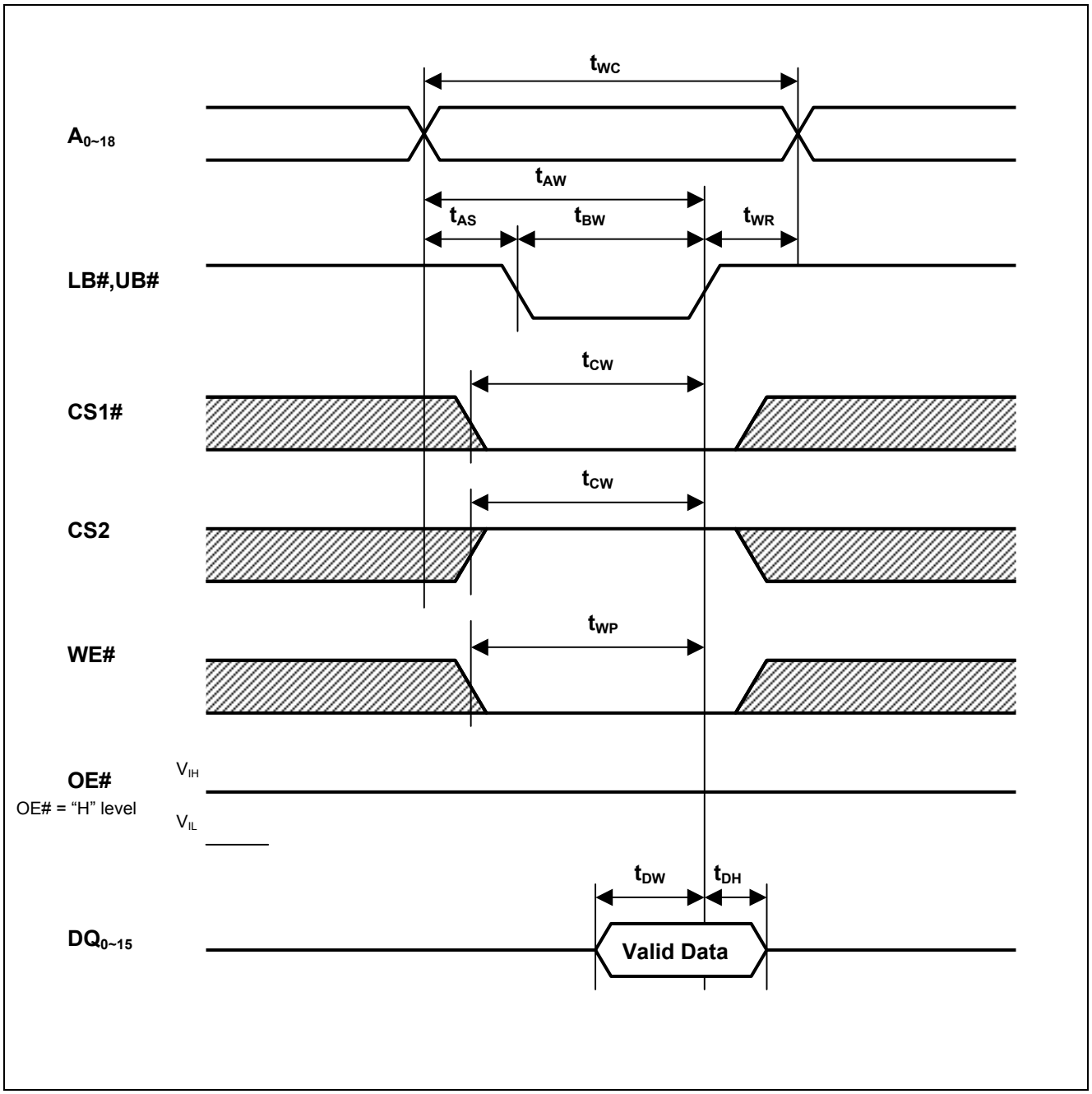
Write Cycle (1) (WE# CLOCK)



Write Cycle (2)　(CS1#, CS2 CLOCK)



Write Cycle (3) (LB#, UB# CLOCK)



Data Retention Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test conditions[*3]	
V_{CC} for data retention	V_{DR}	1.5	-	3.6	V	Vin ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS1# ≥ V_{CC}-0.2V, CS2 ≥ V_{CC}-0.2V or (3) LB# = UB# ≥ V_{CC}-0.2V, CS1# ≤ 0.2V, CS2 ≥ V_{CC}-0.2V	
Data retention current	I_{CCDR}	-	1.2[*1]	4	µA	~+25°C	Vcc=3.0V, Vin ≥ 0V (1) 0V ≤ CS2 ≤ 0.2V or (2) CS1# ≥ V_{CC}-0.2V, CS2 ≥ V_{CC}-0.2V or (3) LB# = UB# ≥ V_{CC}-0.2V, CS1# ≤ 0.2V, CS2 ≥ V_{CC}-0.2V
		-	3[*2]	6	µA	~+40°C	
		-	-	15	µA	~+70°C	
		-	-	20	µA	~+85°C	
Chip select to data retention time	t_{CDR}	0	-	-	ns	See retention waveform.	
Operation recovery time	t_R	5	-	-	ms		

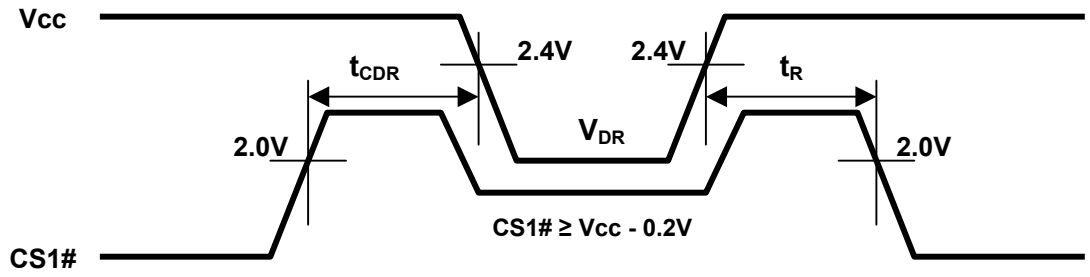
Note 1.Typical parameter indicates the value for the center of distribution at 3.0V(Ta=+25°C), and not 100% tested.

2.Typical parameter indicates the value for the center of distribution at 3.0V(Ta=+40°C), and not 100% tested.

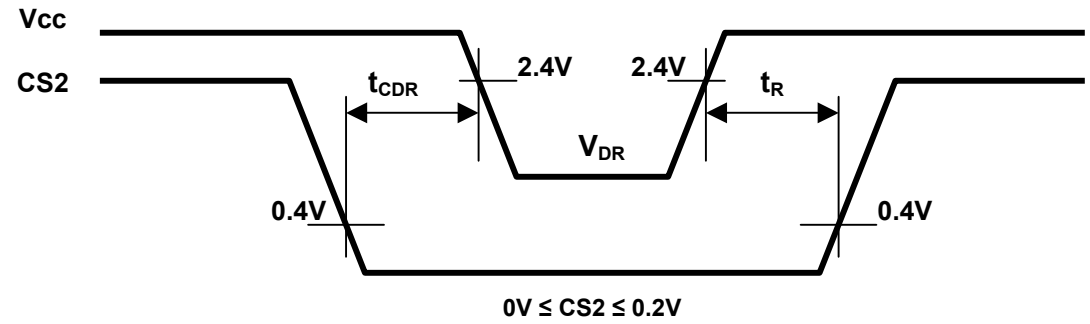
3.CS2 controls address buffer, WE# buffer, CS1# Buffer, OE# buffer, LB#, UB# buffer and Din buffer.
If CS2 controls data retention mode, Vin levels (address, WE#, OE#, LB#, UB#, DQ) can be in the high impedance state. If CS1# controls data retention mode, CS2 must be CS2 ≥ V_{CC}-0.2V or 0V ≤ CS2 ≤ 0.2V .
The other inputs levels (address, WE#, OE#, CS1#, LB#, UB#, DQ) can be in the high impedance state.

Data Retention Timing Waveforms

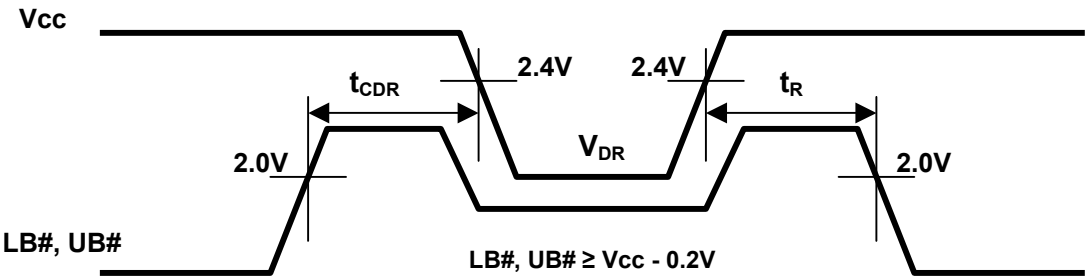
(1) CS1# controlled



(2) CS2 controlled



(3) LB#, UB# controlled



Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

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, AZIACenter, 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

Colophon .7.2

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document 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 Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. 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.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. 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.
5. When exporting the 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. You should not use Renesas Electronics products or the 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. 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.
6. 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.
7. Renesas Electronics products are classified according to the following three quality grades: "Standard", "High Quality", and "Specific". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below. 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 categorized as "Specific" without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. 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 an application categorized as "Specific" or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is "Standard" unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   "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.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   "Specific": Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. 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.
9. 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 system 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. 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.
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.