

R1RW0416DI Series

Wide Temperature Range Version
4M High Speed SRAM (256-kword × 16-bit)

REJ03C0109-0201
Rev.2.01
Jun 16, 2010

Description

The R1RW0416DI is a 4-Mbit high speed static RAM organized 256-kword × 16-bit. It has realized high speed access time by employing CMOS process (6-transistor memory cell) and high speed circuit designing technology. It is most appropriate for the application which requires high speed, high density memory and wide bit width configuration, such as cache and buffer memory in system. The R1RW0416DI is packaged in 400-mil 44-pin SOJ and 400-mil 44-pin plastic TSOPII for high density surface mounting.

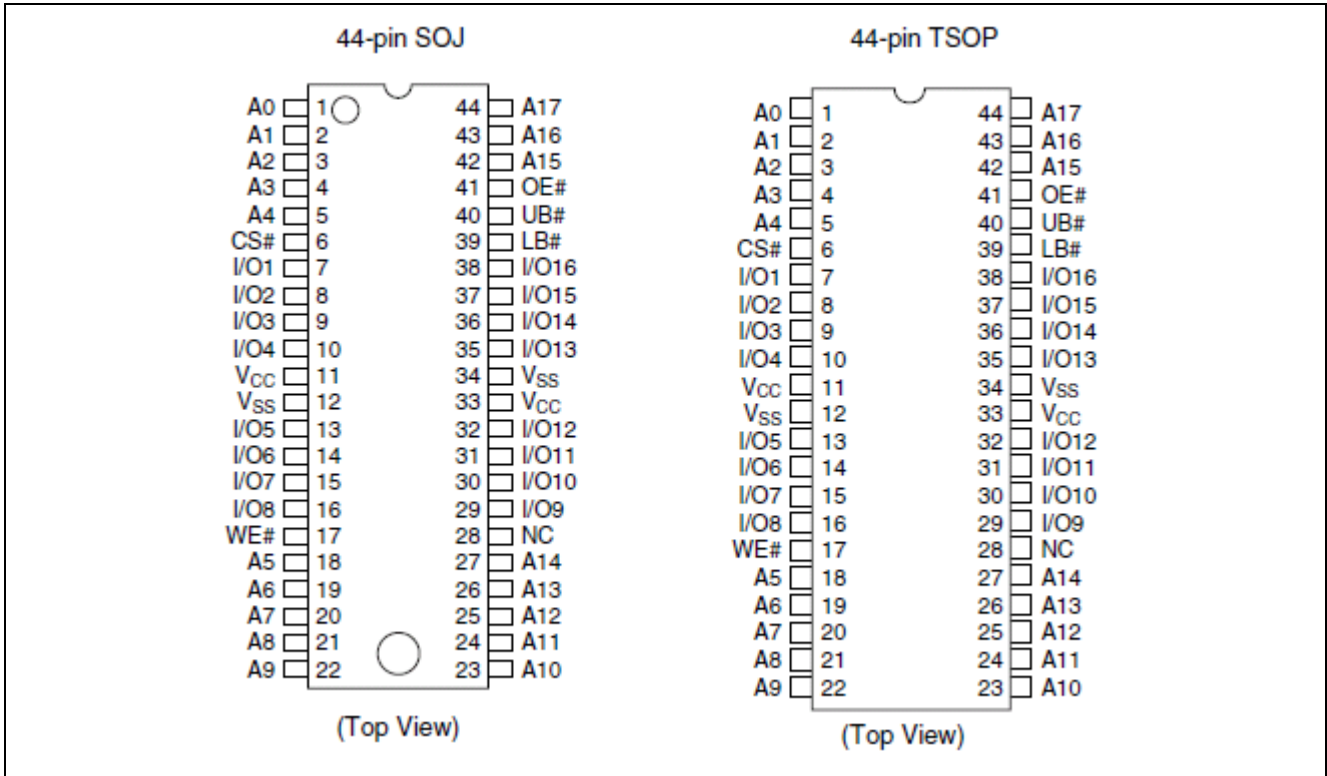
Features

- Single 3.3 V supply: 3.3 V ± 0.3 V
- Access time: 10ns/12 ns (max)
- Completely static memory
 - No clock or timing strobe required
- Equal access and cycle times
- Directly TTL compatible
 - All inputs and outputs
- Operating current: 145/130 mA (max)
- TTL standby current: 40 mA (max)
- CMOS standby current: 5 mA (max)
- Center V_{CC} and V_{SS} type pin out
- Temperature range: -40 to +85°C

Ordering Information

Type No.	Access time	Package
R1RW0416DGE-0PI	10ns	400-mil 44-pin plastic SOJ (44P0K)
R1RW0416DGE-2PI	12 ns	
R1RW0416DSB-0PI	10 ns	400-mil 44-pin plastic TSOPII (44P3W-H)
R1RW0416DSB-2PI	12 ns	

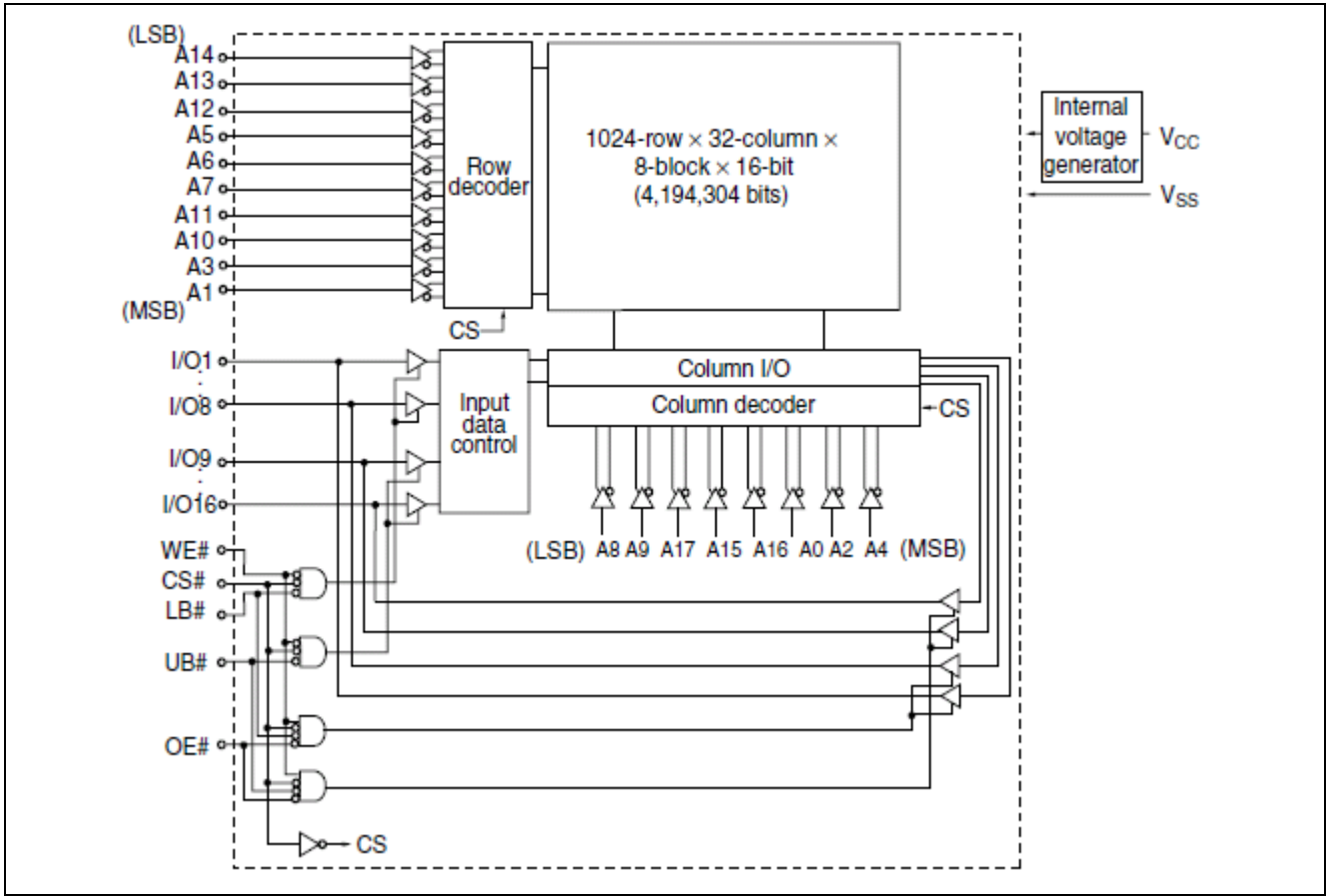
Pin Arrangement



Pin Description

Pin name	Function
A0 to A17	Address input
I/O1 to I/O16	Data input/output
CS#	Chip select
OE#	Output enable
WE#	Write enable
UB#	Upper byte select
LB#	Lower byte select
V _{CC}	Power supply
V _{SS}	Ground
NC	No connection

Block Diagram



Operation Table

CS#	OE#	WE#	LB#	UB#	Mode	V _{CC} current	I/O1–I/O8	I/O9–I/O16	Ref. Cycle
H	×	×	×	×	Standby	I _{SB} , I _{SB1}	High-Z	High-Z	—
L	H	H	×	×	Output disable	I _{CC}	High-Z	High-Z	—
L	L	H	L	L	Read	I _{CC}	Output	Output	Read cycle
L	L	H	L	H	Lower byte read	I _{CC}	Output	High-Z	Read cycle
L	L	H	H	L	Upper byte read	I _{CC}	High-Z	Output	Read cycle
L	L	H	H	H	—	I _{CC}	High-Z	High-Z	—
L	×	L	L	L	Write	I _{CC}	Input	Input	Write cycle
L	×	L	L	H	Lower byte write	I _{CC}	Input	High-Z	Write cycle
L	×	L	H	L	Upper byte write	I _{CC}	High-Z	Input	Write cycle
L	×	L	H	H	—	I _{CC}	High-Z	High-Z	—

Note: H: V_{IH}, L: V_{IL}, ×: V_{IH} or V_{IL}

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply voltage relative to V _{SS}	V _{CC}	–0.5 to +4.6	V
Voltage on any pin relative to V _{SS}	V _T	–0.5* ¹ to V _{CC} + 0.5* ²	V
Power dissipation	P _T	1.0	W
Operating temperature	T _{opr}	–40 to +85	°C
Storage temperature	T _{stg}	–55 to +125	°C
Storage temperature under bias	T _{bias}	–40 to +85	°C

Notes: 1. V_T (min) = –2.0 V for pulse width (under shoot) ≤ 6 ns

2. V_T (max) = V_{CC} + 2.0 V for pulse width (over shoot) ≤ 6 ns

Recommended DC Operating Conditions

(Ta = -40 to +85°C)

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}^{*3}	3.0	3.3	3.6	V
	V_{SS}^{*4}	0	0	0	V
Input voltage	V_{IH}	2.0	—	$V_{CC} + 0.5^{*2}$	V
	V_{IL}	-0.5^{*1}	—	0.8	V

- Notes: 1. V_{IL} (min) = -2.0 V for pulse width (under shoot) ≤ 6 ns
 2. V_{IH} (max) = $V_{CC} + 2.0$ V for pulse width (over shoot) ≤ 6 ns
 3. The supply voltage with all V_{CC} pins must be on the same level.
 4. The supply voltage with all V_{SS} pins must be on the same level.

DC Characteristics

(Ta = -40 to +85°C, $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$, $V_{SS} = 0 \text{ V}$)

Parameter	Symbol	Min	Max	Unit	Test conditions
Input leakage current	$ I_{LI} $	—	2	μA	$V_{IN} = V_{SS}$ to V_{CC}
Output leakage current	$ I_{LO} $	—	2	μA	$V_{IN} = V_{SS}$ to V_{CC}
Operating power supply current	I_{CC}	—	130	mA	Min cycle CS# = V_{IL} , $I_{OUT} = 0 \text{ mA}$ Other inputs = V_{IH}/V_{IL}
Standby power supply current	I_{SB}	—	40	mA	Min cycle, CS# = V_{IH} , Other inputs = V_{IH}/V_{IL}
	I_{SB1}	—	5	mA	f = 0 MHz $V_{CC} \geq \text{CS\#} \geq V_{CC} - 0.2 \text{ V}$, (1) $0 \text{ V} \leq V_{IN} \leq 0.2 \text{ V}$ or (2) $V_{CC} \geq V_{IN} \geq V_{CC} - 0.2 \text{ V}$
Output voltage	V_{OL}	—	0.4	V	$I_{OL} = 8 \text{ mA}$
	V_{OH}	2.4	—	V	$I_{OH} = -4 \text{ mA}$

Capacitance

(Ta = +25°C, f = 1.0 MHz)

Parameter	Symbol	Min	Max	Unit	Test conditions
Input capacitance ^{*1}	C_{IN}	—	6	pF	$V_{IN} = 0 \text{ V}$
Input/output capacitance ^{*1}	$C_{I/O}$	—	8	pF	$V_{I/O} = 0 \text{ V}$

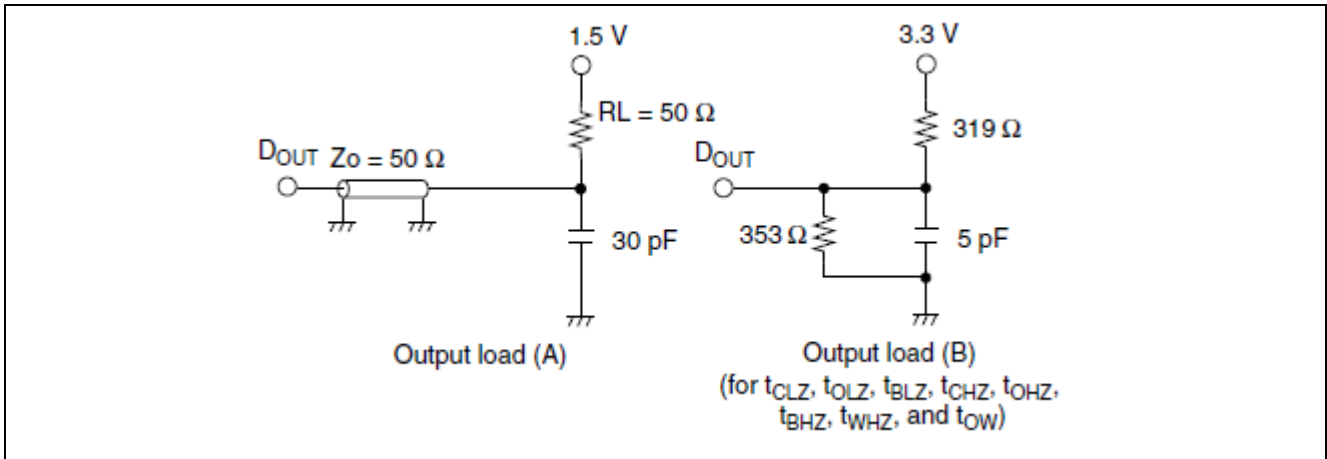
Note: 1. This parameter is sampled and not 100% tested.

AC Characteristics

($T_a = -40$ to $+85^\circ\text{C}$, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$, unless otherwise noted.)

Test Conditions

- Input pulse levels: 3.0 V/0.0 V
- Input rise and fall time: 3 ns
- Input and output timing reference levels: 1.5 V
- Output load: See figures (Including scope and jig)



Read Cycle

Parameter	Symbol	R1RW0416DI				Unit	Notes
		10ns Version		12ns Version			
		Min	Max	Min	Max		
Read cycle time	t_{RC}	10	—	12	—	ns	
Address access time	t_{AA}	—	10	—	12	ns	
Chip select access time	t_{ACS}	—	10	—	12	ns	
Output enable to output valid	t_{OE}	—	5	—	6	ns	
Byte select to output valid	t_{BA}	—	5	—	6	ns	
Output hold from address change	t_{OH}	3	—	3	—	ns	
Chip select to output in low-Z	t_{CLZ}	3	—	3	—	ns	1
Output enable to output in low-Z	t_{OLZ}	0	—	0	—	ns	1
Byte select to output in low-Z	t_{BLZ}	0	—	0	—	ns	1
Chip deselect to output in high-Z	t_{CHZ}	—	5	—	6	ns	1
Output disable to output in high-Z	t_{OHZ}	—	5	—	6	ns	1
Byte deselect to output in high-Z	t_{BHZ}	—	5	—	6	ns	1

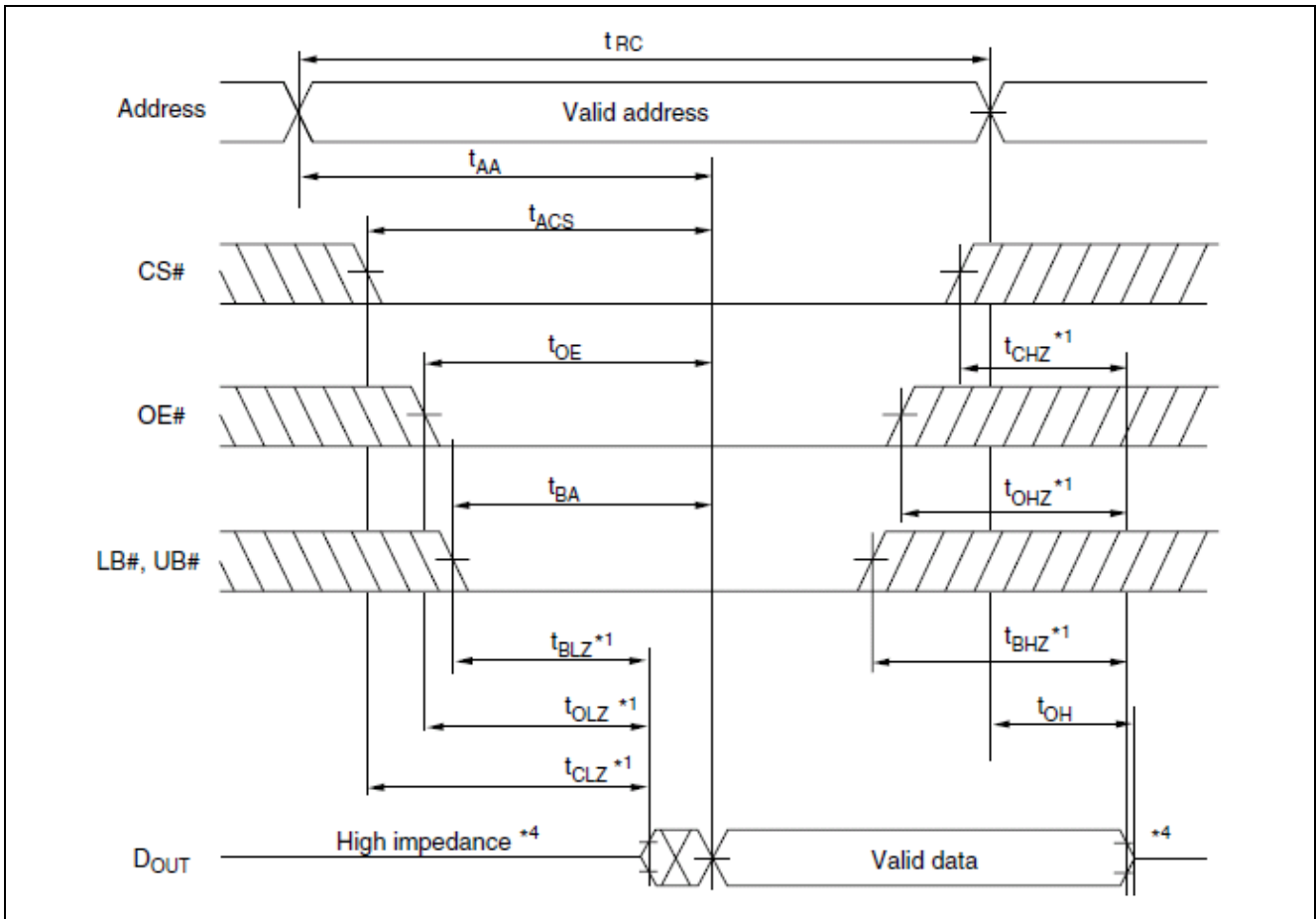
Write Cycle

Parameter	Symbol	R1RW0416DI				Unit	Notes
		10ns Version		12ns Version			
		Min	Max	Min	Max		
Write cycle time	t _{WC}	10	—	12	—	ns	
Address valid to end of write	t _{AW}	7	—	8	—	ns	
Chip select to end of write	t _{CW}	7	—	8	—	ns	8
Write pulse width	t _{WP}	7	—	8	—	ns	7
Byte select to end of write	t _{BW}	7	—	8	—	ns	
Address setup time	t _{AS}	0	—	0	—	ns	5
Write recovery time	t _{WR}	0	—	0	—	ns	6
Data to write time overlap	t _{DW}	5	—	6	—	ns	
Data hold from write time	t _{DH}	0	—	0	—	ns	
Write disable to output in low-Z	t _{OW}	3	—	3	—	ns	1
Output disable to output in high-Z	t _{OZH}	—	5	—	6	ns	1
Write enable to output in high-Z	t _{WHZ}	—	5	—	6	ns	1

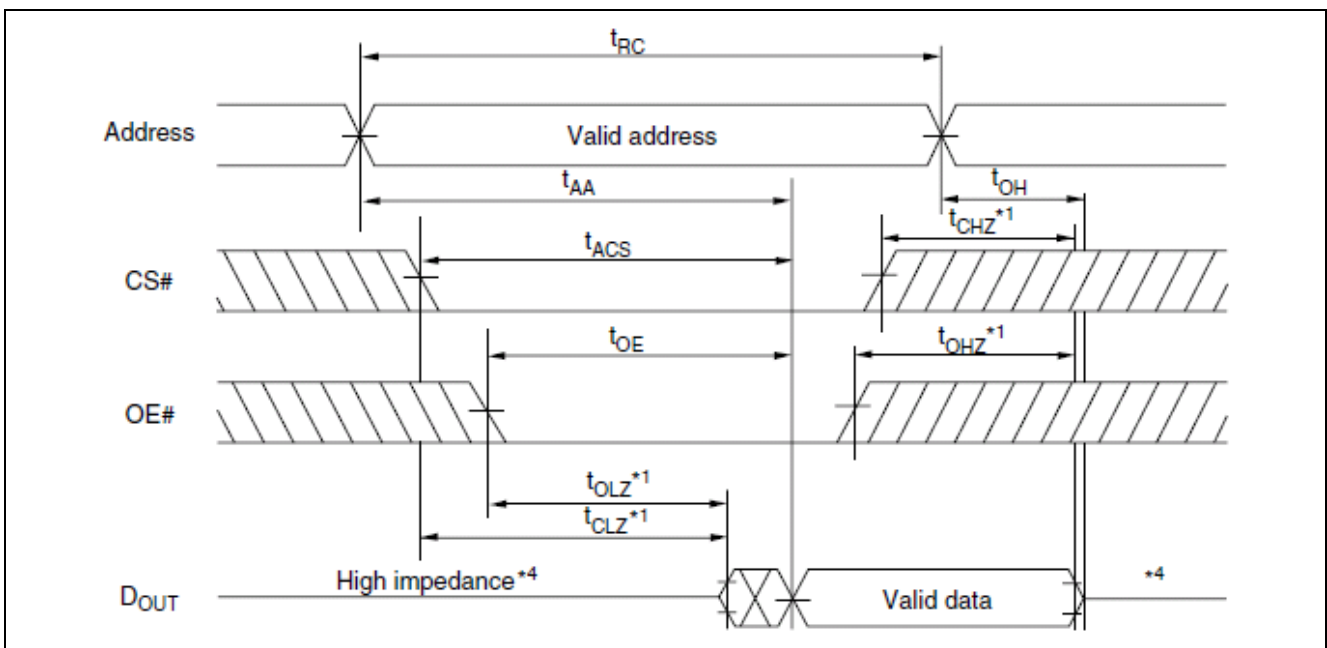
- Notes: 1. Transition is measured ± 200 mV from steady voltage with output load (B). This parameter is sampled and not 100% tested.
2. If the CS# or LB# or UB# low transition occurs simultaneously with the WE# low transition or after the WE# transition, output remains a high impedance state.
 3. WE# and/or CS# must be high during address transition time.
 4. If CS#, OE#, LB# and UB# are low during this period, I/O pins are in the output state. Then the data input signals of opposite phase to the outputs must not be applied to them.
 5. t_{AS} is measured from the latest address transition to the latest of CS#, WE#, LB# or UB# going low.
 6. t_{WR} is measured from the earliest of CS#, WE#, LB# or UB# going high to the first address transition.
 7. A write occurs during the overlap of a low CS#, a low WE# and a low LB# or a low UB# (t_{WP}). A write begins at the latest transition among CS# going low, WE# going low and LB# going low or UB# going low. A write ends at the earliest transition among CS# going high, WE# going high and LB# going high or UB# going high.
 8. t_{CW} is measured from the later of CS# going low to the end of write.

Timing Waveforms

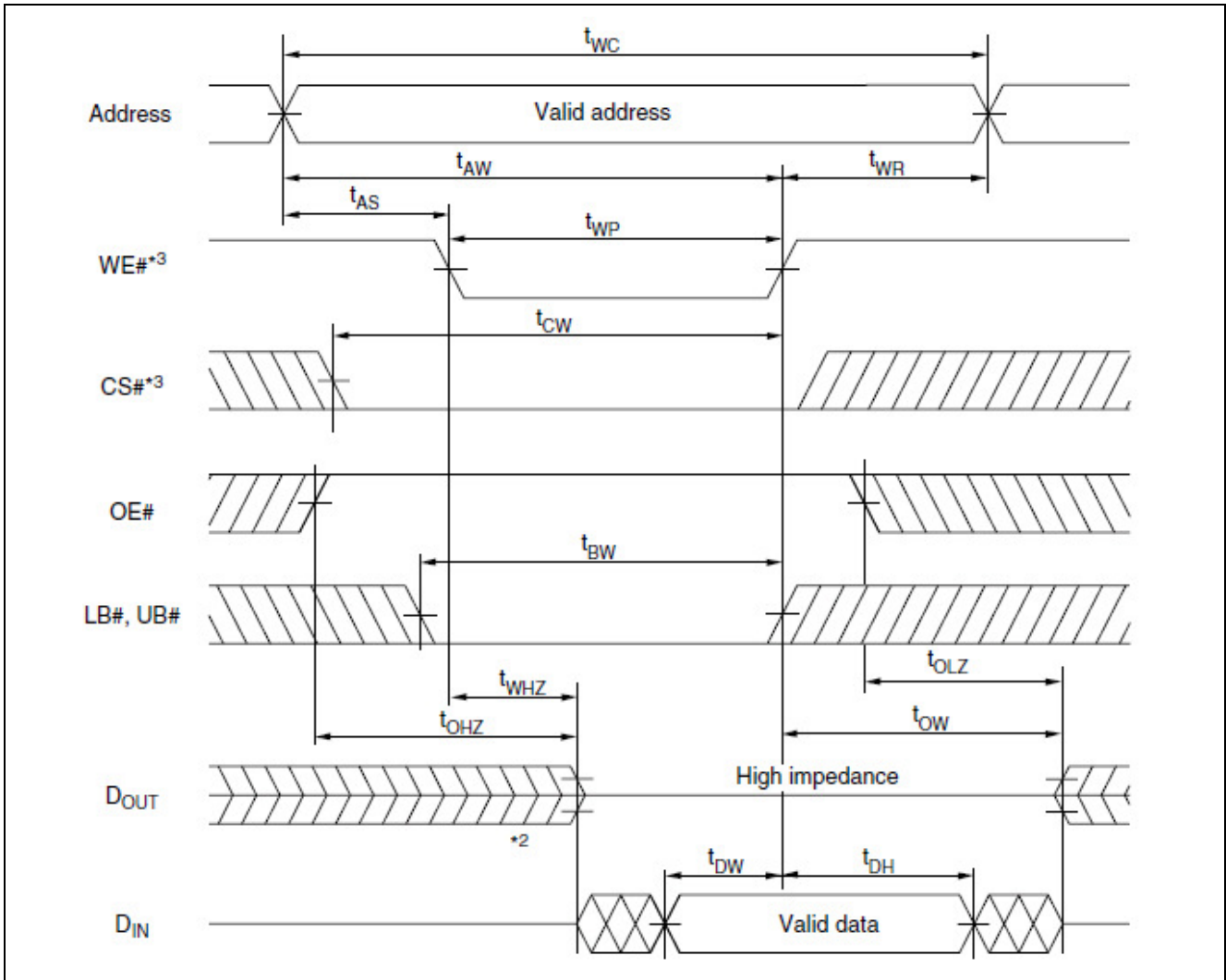
Read Timing Waveform (1) (WE# = V_{IH})



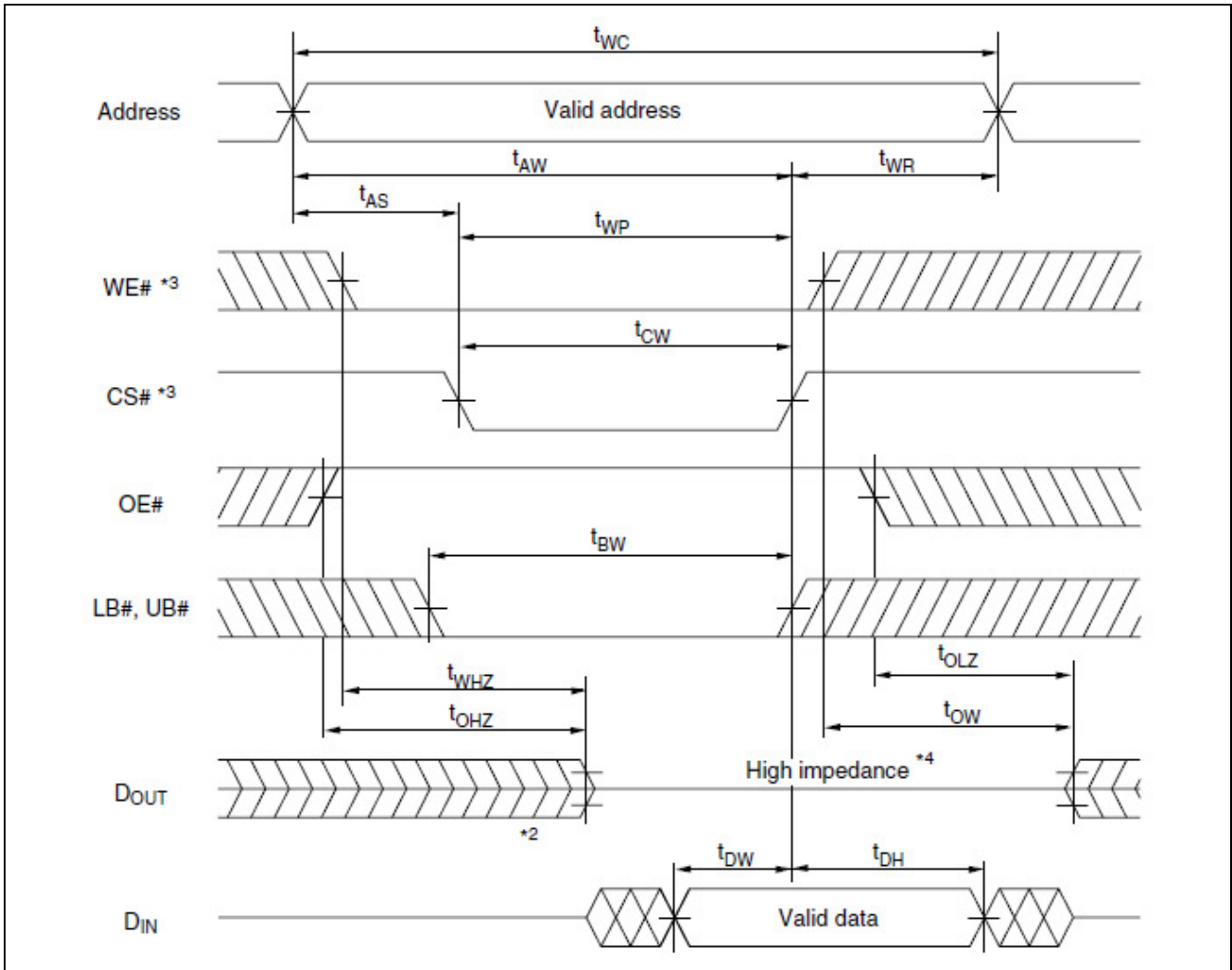
Read Timing Waveform (2) (WE# = V_{IH}, LB# = V_{IL}, UB# = V_{IL})



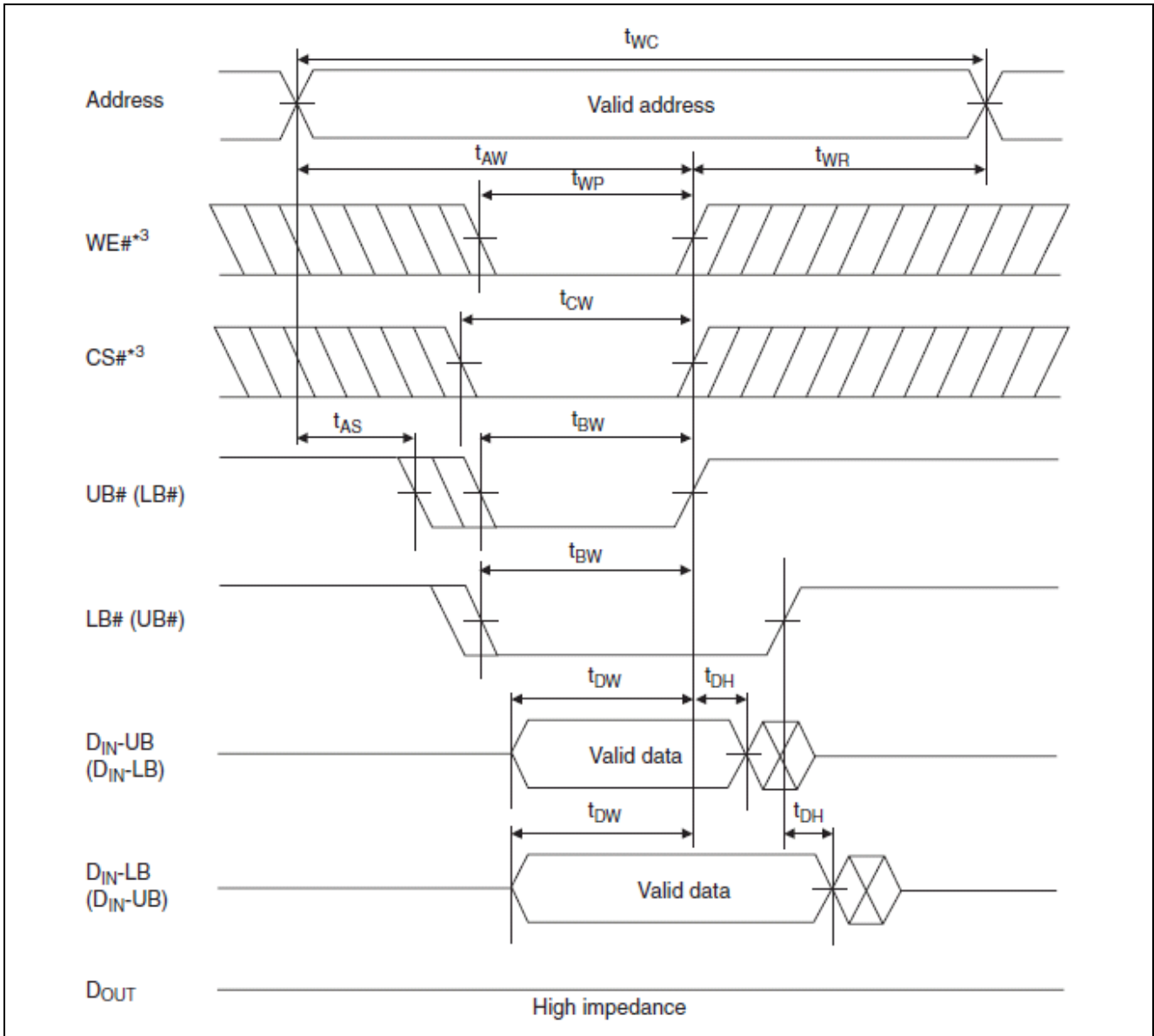
Write Timing Waveform (1) (WE# Controlled)



Write Timing Waveform (2) (CS# Controlled)



Write Timing Waveform (3) (LB#, UB# Controlled, OE# = V_{IH})



Revision History	R1RW0416DI Series data sheet
-------------------------	-------------------------------------

Rev.	Date	Description	
		Page	Summary
0.01	Sep. 30, 2003	-	Initial issue
1.00	Mar. 12, 2004	--	Deletion of Preliminary
2.00	May. 01, 2009	- P1 P5 P6/P7	Addition of access grade 10ns version. The product lineup :R1RW0416DSB-0PI/DGE-0PI is added. Operating power supply current of 10ns cycle version is described to the DC characteristic. The timing standard of 10ns version is described at the read cycle The timing standard of 10ns version is described at the write cycle
2.01	Jun. 16, 2010	-	Change the format, 'Renesas Electronics Corporation',

All documents should contain the following section break and paragraph as the last item. The footers of this document refer to the paragraph in order to reference the last page of the document.

Notice

- 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.
- 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.
- You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
- 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.
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.
7F, 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 Laviel'or Bldg., 720-2 Yeoksam-Dong, Kangnam-Ku, Seoul 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [SRAM](#) category:

Click to view products by [Renesas](#) manufacturer:

Other Similar products are found below :

[5962-8855206XA](#) [CY6116A-35DMB](#) [CY7C128A-45DMB](#) [CY7C1461KV33-133AXI](#) [CY7C199-45LMB](#) [GS8161Z36DD-200I](#) [GS88237CB-200I](#) [R1QDA7236ABB-20IB0](#) [RMLV0408EGSB-4S2#AA0](#) [IS64WV3216BLL-15CTLA3](#) [IS66WVE4M16ECLL-70BLI](#) [PCF8570P](#) [K6T4008C1B-GB70](#) [CY7C1353S-100AXC](#) [AS6C8016-55BIN](#) [AS7C164A-15PCN](#) [515712X](#) [IS62WV51216EBLL-45BLI](#) [IS63WV1288DBLL-10HLI](#) [IS66WVE2M16ECLL-70BLI](#) [47L16-E/SN](#) [IS66WVE4M16EALL-70BLI](#) [IS62WV6416DBLL-45BLI](#) [IS61WV102416DBLL-10TLI](#) [CY7C1381KV33-100AXC](#) [CY7C1381KV33-100BZXI](#) [CY7C1373KV33-100AXC](#) [CY7C1381KVE33-133AXI](#) [CY7C4042KV13-933FCXC](#) [8602501XA](#) [5962-3829425MUA](#) [5962-8855206YA](#) [5962-8866201XA](#) [5962-8866201YA](#) [5962-8866204TA](#) [5962-8866206MA](#) [5962-8866207NA](#) [5962-8866208UA](#) [5962-8872502XA](#) [5962-8959836MZA](#) [5962-8959841MZA](#) [5962-9062007MXA](#) [5962-9161705MXA](#) [N08L63W2AB7I](#) [7130LA100PDG](#) [GS81284Z36B-250I](#) [M38510/28902BVA](#) [IS62WV12816ALL-70BLI](#) [5962-8971203XA](#) [5962-8971202ZA](#)