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# HB56SW832DZJ Series

32 MB EDO DRAM S.O.DIMM  
8-Mword  $\times$  32-bit, 2 k Refresh, 2-Bank Module  
(16 pcs of 4 M  $\times$  4 Components)

# HITACHI

ADE-203-790B (Z)  
Rev.2.0  
Nov. 1997

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## Description

The HB56SW832DZJ is a 8M  $\times$  32 dynamic RAM Small Outline Dual In-line Memory Module (S.O.DIMM), mounted 16 pieces of 16-Mbit DRAM (HM51W17405) sealed in TCP package. An outline of the HB56SW832DZJ is 72-pin Zig Zag Dual tabs socket type compact and thin package. Therefore, the HB56SW832DZJ makes high density mounting possible without surface mount technology. The HB56SW832DZJ provides common data inputs and outputs. Decoupling capacitors are mounted on the module board.

## Features

- 72-pin Zig Zag Dual tabs socket type
  - Outline: 59.69 mm (Length)  $\times$  25.40 mm (Height)  $\times$  3.80 mm (Thickness)
  - Lead pitch: 1.27 mm
- Single 3.3 V (+0.3 V, -0.15 V) supply
- High speed
  - Access time:  $t_{\text{RAC}} = 60/70$  ns (max)
  - $t_{\text{CAC}} = 15/18$  ns (max)
- Low power dissipation
  - Active mode: 2.74/2.45 W (max)
  - Standby mode (TTL): 115.2 mW (max)
  - (CMOS): 8.64 mW (max) (L/LS-version)
- EDO mode capability
- Refresh period
  - 2048 refresh cycles: 32 ms
  - 128 ms (L/LS-version)
- 3 variations of refresh
  - $\overline{\text{RAS}}$ -only refresh
  - $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh
  - Self refresh (LS-version)

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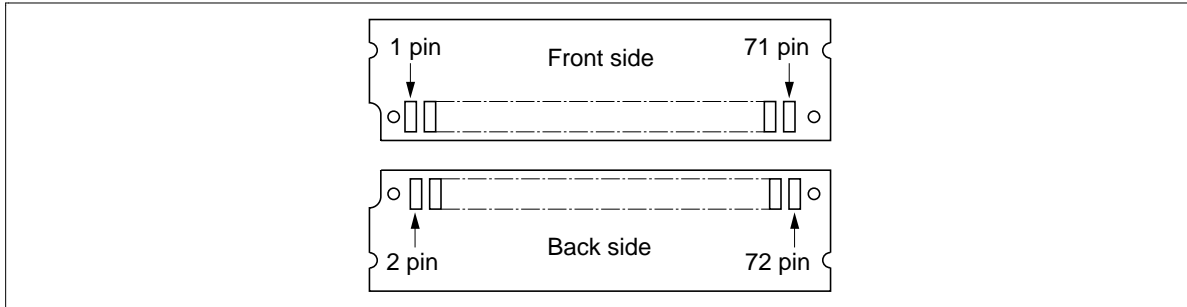
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### Ordering Information

Type No.	Access time	Package	Contact pad
HB56SW832DZJ-6	60 ns	72-pin small outline DIMM	Gold
HB56SW832DZJ-7	70 ns		
HB56SW832DZJ-6L	60 ns		
HB56SW832DZJ-7L	70 ns		
HB56SW832DZJ-6LS	60 ns		
HB56SW832DZJ-7LS	70 ns		

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Pin Arrangement



Pin Arrangement

Front side		Back side					
Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	V <sub>SS</sub>	37	DQ18	2	DQ0	38	DQ19
3	DQ1	39	V <sub>SS</sub>	4	DQ2	40	$\overline{\text{CE}}0$
5	DQ3	41	$\overline{\text{CE}}2$	6	DQ4	42	$\overline{\text{CE}}3$
7	DQ5	43	$\overline{\text{CE}}1$	8	DQ6	44	$\overline{\text{RE}}0$
9	DQ7	45	$\overline{\text{RE}}1$	10	V <sub>CC</sub>	46	NC
11	PD1	47	$\overline{\text{WE}}$	12	A0	48	NC
13	A1	49	DQ20	14	A2	50	DQ21
15	A3	51	DQ22	16	A4	52	DQ23
17	A5	53	DQ24	18	A6	54	DQ25
19	A10	55	NC	20	NC	56	DQ27
21	DQ9	57	DQ28	22	DQ10	58	DQ29
23	DQ11	59	DQ31	24	DQ12	60	DQ30
25	DQ13	61	V <sub>CC</sub>	26	DQ14	62	DQ32
27	DQ15	63	DQ33	28	A7	64	DQ34
29	NC	65	NC	30	V <sub>CC</sub>	66	PD2
31	A8	67	PD3	32	A9	68	PD4
33	$\overline{\text{RE}}3$	69	PD5	34	$\overline{\text{RE}}2$	70	PD6
35	DQ16	71	PD7	36	NC	72	V <sub>SS</sub>

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## HB56SW832DZJ Series

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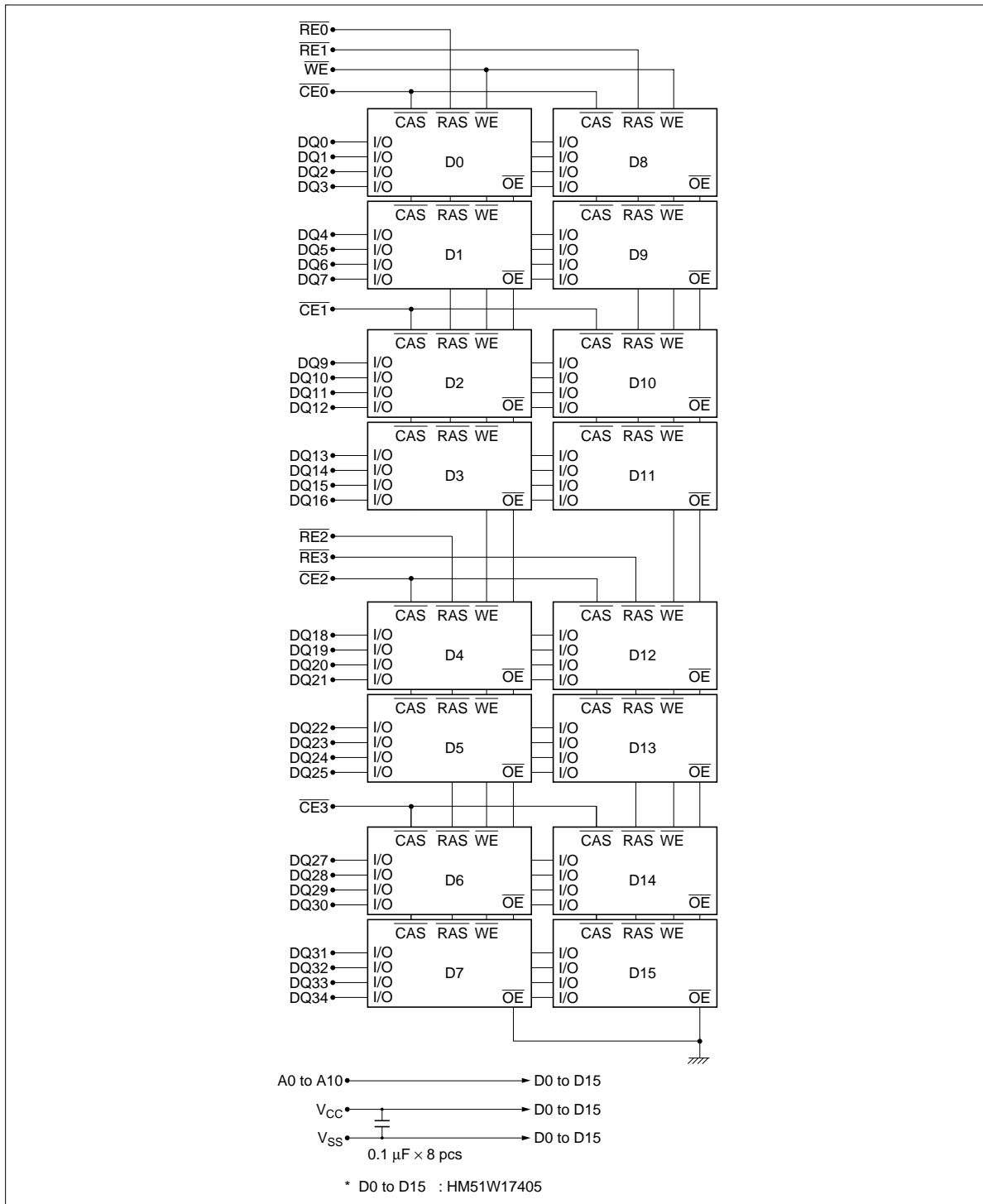
### Pin Description

Pin name	Function
A0 to A10	Address inputs: Row address: A0 to A10 Column address: A0 to A10 Refresh address: A0 to A10
DQ0 to DQ7, DQ9 to DQ16, DQ18 to DQ25, DQ27 to DQ34	Data-in/Data-out
$\overline{RE0}$ to $\overline{RE3}$	Row address strobe ( $\overline{RAS}$ )
$\overline{CE0}$ to $\overline{CE3}$	column address strobe ( $\overline{CAS}$ )
$\overline{WE}$	Read/Write enable
$V_{CC}$	Power supply
$V_{SS}$	Ground
PD1 to PD7	Presence detect
NC	No connection

### Presence Detect Pin Arrangement

Pin No.	Pin name	Function	
		60 ns	70 ns
11	PD1	NC	NC
66	PD2	NC	NC
67	PD3	$V_{SS}$	$V_{SS}$
68	PD4	$V_{SS}$	$V_{SS}$
69	PD5	NC	$V_{SS}$
70	PD6	NC	NC
71	PD7	NC	NC
	PD7 (LS-version)	$V_{SS}$	$V_{SS}$

Block Diagram



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### Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Voltage on any pin relative to $V_{SS}$	$V_T$	-0.5 to +4.6	V
Supply voltage relative to $V_{SS}$	$V_{CC}$	-0.5 to +4.6	V
Short circuit output current	$I_{out}$	50	mA
Power dissipation	$P_t$	8	W
Operating temperature	$T_{opr}$	0 to +70	°C
Storage temperature	$T_{stg}$	-55 to +125	°C

### Recommended DC Operating Conditions ( $T_a = 0$ to $70^\circ\text{C}$ )

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply voltage	$V_{SS}$	0	0	0	V	
	$V_{CC}$	3.15	3.3	3.6	V	1
Input high voltage	$V_{IH}$	2.0	—	$V_{CC} + 0.3$	V	1
Input low voltage	$V_{IL}$	-0.3	—	0.8	V	1

Note: 1. All voltage referred to  $V_{SS}$ .

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**DC Characteristics** ( $T_a = 0$  to  $70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V} + 0.3\text{ V}$ ,  $-0.15\text{ V}$ ,  $V_{SS} = 0\text{ V}$ )

Parameter	Symbol	60 ns		70 ns		Unit	Test conditions	Notes
		Min	Max	Min	Max			
Operating current	$I_{CC1}$	—	760	—	680	mA	$t_{RC} = \text{min}$	1, 2
Standby current	$I_{CC2}$	—	32	—	32	mA	TTL interface $\overline{\text{RAS}}, \overline{\text{CAS}} = V_{IH}$ Dout = High-Z	
		—	16	—	16	mA	CMOS interface $\overline{\text{RAS}}, \overline{\text{CAS}} \geq V_{CC} - 0.2\text{ V}$ Dout = High-Z	
Standby current (L/LS-version)	$I_{CC2}$	—	2.4	—	2.4	mA	CMOS interface $\overline{\text{RAS}}, \overline{\text{CAS}} \geq V_{CC} - 0.2\text{ V}$ Dout = High-Z	
$\overline{\text{RAS}}$ -only refresh current	$I_{CC3}$	—	760	—	640	mA	$t_{RC} = \text{min}$	2
Standby current	$I_{CC5}$	—	80	—	80	mA	$\overline{\text{RAS}} = V_{IH}, \overline{\text{CAS}} = V_{IL}$ Dout = enable	1
$\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ refresh current	$I_{CC6}$	—	760	—	680	mA	$t_{RC} = \text{min}$	
EDO page mode current	$I_{CC7}$	—	680	—	640	mA	$t_{HPC} = \text{min}$	1, 3
Battery backup current (Standby with CBR refresh) (L/LS-version)	$I_{CC10}$	—	6.4	—	6.4	mA	CMOS interface Dout = High-Z CBR refresh: $t_{RC} = 62.5\ \mu\text{s}$ $t_{RAS} \leq 0.3\ \mu\text{s}$	
Self refresh mode current (LS-version)	$I_{CC11}$	—	4.0	—	4.0	mA	CMOS interface $\overline{\text{RAS}}, \overline{\text{CAS}} \leq 0.2\text{ V}$ Dout = High-Z	
Input leakage current	$I_{LI}$	-10	10	-10	10	$\mu\text{A}$	$0\text{ V} \leq V_{in} \leq 4.6\text{ V}$	
Output leakage current	$I_{LO}$	-10	10	-10	10	$\mu\text{A}$	$0\text{ V} \leq V_{out} \leq 4.6\text{ V}$ Dout = disable	
Output high voltage	$V_{OH}$	2.4	$V_{CC}$	2.4	$V_{CC}$	V	High Iout = -2 mA	
Output low voltage	$V_{OL}$	0	0.4	0	0.4	V	Low Iout = 2 mA	

Notes: 1.  $I_{CC}$  depends on output load condition when the device is selected,  $I_{CC}$  max is specified at the output open condition.

2. Address can be changed once or less while  $\overline{\text{RAS}} = V_{IL}$ .

3. Address can be changed once or less while  $\overline{\text{CAS}} = V_{IH}$ .

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**Capacitance** ( $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V} + 0.3\text{ V}$ ,  $-0.15\text{ V}$ )

Parameter	Symbol	Typ	Max	Unit	Notes
Input capacitance (Address)	$C_{i1}$	—	100	pF	1
Input capacitance ( $\overline{WE}$ )	$C_{i2}$	—	132	pF	1
Input capacitance ( $\overline{CAS}$ )	$C_{i3}$	—	48	pF	1
Input capacitance ( $\overline{RAS}$ )	$C_{i4}$	—	48	pF	1
I/O capacitance (DQ)	$C_{i/O}$	—	25	pF	1, 2

Notes: 1. Capacitance measured with Boonton Meter or effective capacitance measuring method.

2.  $\overline{CAS} = V_{ih}$  to disable Dout.

**AC Characteristics** ( $T_a = 0$  to  $70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{ V} + 0.3\text{ V}$ ,  $-0.15\text{ V}$ ,  $V_{SS} = 0\text{ V}$ ) \*<sup>1</sup>, \*<sup>2</sup>, \*<sup>18</sup>

### Test Conditions

- Input rise and fall times: 2 ns
- Input levels: 0 V, 3.0 V
- Input timing reference levels: 0.8 V, 2.0 V
- Output timing reference levels: 0.8 V, 2.0 V
- Output load: 1 TTL gate +  $C_L$  (100 pF) (Including scope and jig)



## HB56SW832DZJ Series

### Read, Write, and Refresh Cycles (Common parameters)

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
Random read or write cycle time	$t_{RC}$	104	—	124	—	ns	
$\overline{RAS}$ precharge time	$t_{RP}$	40	—	50	—	ns	
$\overline{CAS}$ precharge time	$t_{CP}$	10	—	13	—	ns	
$\overline{RAS}$ pulse width	$t_{RAS}$	60	10000	70	10000	ns	
$\overline{CAS}$ pulse width	$t_{CAS}$	10	10000	13	10000	ns	
Row address setup time	$t_{ASR}$	0	—	0	—	ns	
Row address hold time	$t_{RAH}$	10	—	10	—	ns	
Column address setup time	$t_{ASC}$	0	—	0	—	ns	
Column address hold time	$t_{CAH}$	10	—	13	—	ns	
$\overline{RAS}$ to $\overline{CAS}$ delay time	$t_{RCD}$	14	45	14	52	ns	3
$\overline{RAS}$ to column address delay time	$t_{RAD}$	12	30	12	35	ns	4
$\overline{RAS}$ hold time	$t_{RSH}$	13	—	13	—	ns	
$\overline{CAS}$ hold time	$t_{CSH}$	40	—	45	—	ns	
$\overline{CAS}$ to $\overline{RAS}$ precharge time	$t_{CRP}$	5	—	5	—	ns	
$\overline{CAS}$ delay time from Din	$t_{DZC}$	0	—	0	—	ns	
Transition time (rise and fall)	$t_T$	2	50	2	50	ns	5
Refresh period (2,048 cycles)	$t_{REF}$	—	32	—	32	ms	
Refresh period (2,048 cycles) (L/LS-version)	$t_{REF}$	—	128	—	128	ms	

## HB56SW832DZJ Series

### Read Cycle

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
Access time from $\overline{\text{RAS}}$	$t_{\text{RAC}}$	—	60	—	70	ns	6, 7
Access time from $\overline{\text{CAS}}$	$t_{\text{CAC}}$	—	15	—	18	ns	7, 8, 15
Access time from address	$t_{\text{AA}}$	—	30	—	35	ns	7, 9, 15
Read command setup time	$t_{\text{RCS}}$	0	—	0	—	ns	
Read command hold time to $\overline{\text{CAS}}$	$t_{\text{RCH}}$	0	—	0	—	ns	10
Read command hold time from $\overline{\text{RAS}}$	$t_{\text{RCHR}}$	60	—	70	—	ns	
Read command hold time to $\overline{\text{RAS}}$	$t_{\text{RRH}}$	5	—	5	—	ns	10
Column address to $\overline{\text{RAS}}$ lead time	$t_{\text{RAL}}$	30	—	35	—	ns	
Column address to $\overline{\text{CAS}}$ lead time	$t_{\text{CAL}}$	18	—	23	—	ns	
$\overline{\text{CAS}}$ to output in low-Z	$t_{\text{CLZ}}$	0	—	0	—	ns	
Output data hold time	$t_{\text{OH}}$	3	—	3	—	ns	19
Output buffer turn-off time	$t_{\text{OFF}}$	—	15	—	15	ns	11, 19
$\overline{\text{CAS}}$ to Din delay time	$t_{\text{CDD}}$	15	—	18	—	ns	
Output data hold time from $\overline{\text{RAS}}$	$t_{\text{OHR}}$	3	—	3	—	ns	19
Output buffer turn-off time to $\overline{\text{RAS}}$	$t_{\text{OFR}}$	—	15	—	15	ns	19
Output buffer turn-off to $\overline{\text{WE}}$	$t_{\text{WEZ}}$	—	15	—	15	ns	
$\overline{\text{WE}}$ to Din delay time	$t_{\text{WED}}$	15	—	18	—	ns	
$\overline{\text{RAS}}$ to Din delay time	$t_{\text{RDD}}$	15	—	18	—	ns	
$\overline{\text{RAS}}$ to next $\overline{\text{CAS}}$ delay time	$t_{\text{RNCD}}$	60	—	70	—	ns	

### Write Cycle

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
Write command setup time	$t_{\text{WCS}}$	0	—	0	—	ns	12
Write command hold time	$t_{\text{WCH}}$	10	—	13	—	ns	
Write command pulse width	$t_{\text{WP}}$	10	—	10	—	ns	
Data-in setup time	$t_{\text{DS}}$	0	—	0	—	ns	13
Data-in hold time	$t_{\text{DH}}$	10	—	13	—	ns	13

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### Refresh Cycle

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
$\overline{\text{CAS}}$ setup time (CBR refresh cycle)	$t_{\text{CSR}}$	5	—	5	—	ns	
$\overline{\text{CAS}}$ hold time (CBR refresh cycle)	$t_{\text{CHR}}$	10	—	10	—	ns	
$\overline{\text{WE}}$ setup time (CBR refresh cycle)	$t_{\text{WRP}}$	0	—	0	—	ns	
$\overline{\text{WE}}$ hold time (CBR refresh cycle)	$t_{\text{WRH}}$	10	—	10	—	ns	
$\overline{\text{RAS}}$ precharge to $\overline{\text{CAS}}$ hold time	$t_{\text{RPC}}$	5	—	5	—	ns	

### EDO Page Mode Cycle

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
EDO page mode cycle time	$t_{\text{HPC}}$	25	—	30	—	ns	16
EDO page mode $\overline{\text{RAS}}$ pulse width	$t_{\text{RASP}}$	—	100000	—	100000	ns	14
Access time from $\overline{\text{CAS}}$ precharge	$t_{\text{CPA}}$	—	35	—	40	ns	7, 15
$\overline{\text{RAS}}$ hold time from $\overline{\text{CAS}}$ precharge	$t_{\text{CPRH}}$	35	—	40	—	ns	
Output data hold time from $\overline{\text{CAS}}$ low	$t_{\text{DOH}}$	3	—	3	—	ns	7, 15
Read command hold time from $\overline{\text{CAS}}$ precharge	$t_{\text{RCHC}}$	35	—	40	—	ns	

### Self Refresh Mode (L/LS-version)

Parameter	Symbol	60 ns		70 ns		Unit	Notes
		Min	Max	Min	Max		
$\overline{\text{RAS}}$ pulse width (Self refresh)	$t_{\text{RASS}}$	100	—	100	—	$\mu\text{s}$	
$\overline{\text{RAS}}$ precharge time (Self refresh)	$t_{\text{RPS}}$	110	—	130	—	ns	
$\overline{\text{CAS}}$ hold time (Self refresh)	$t_{\text{CHS}}$	-50	—	-50	—	ns	

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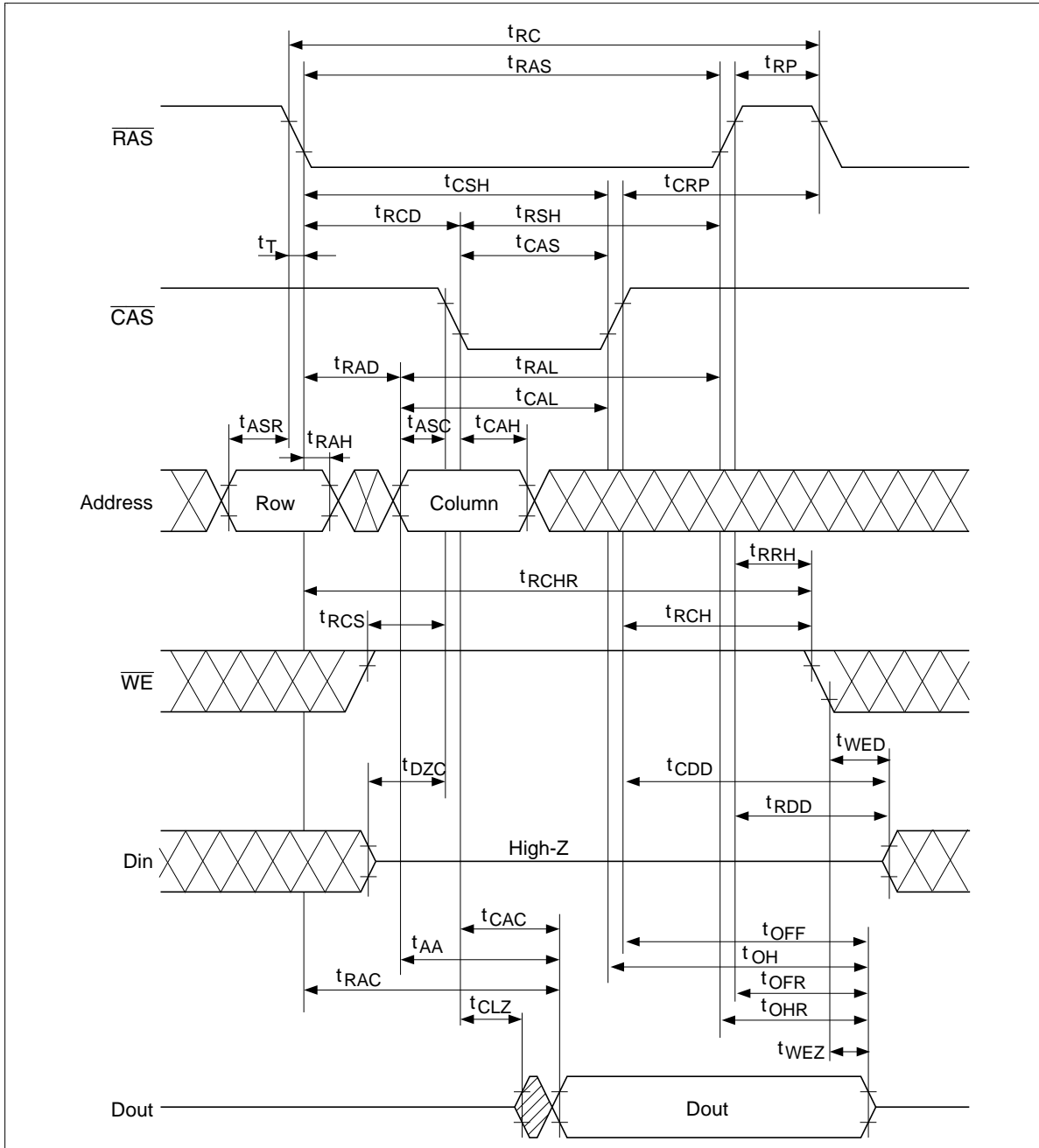
## HB56SW832DZJ Series

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- Notes:
1. AC measurements assume  $t_r = 2$  ns.
  2. An initial pause of 200  $\mu$ s is required after power up followed by a minimum of eight initialization cycles (any combination of cycles containing  $\overline{\text{RAS}}$ -only refresh cycle or  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh). If the internal refresh counter is used, a minimum of eight  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh cycles are required.
  3. Operation with the  $t_{\text{RCD}}$  (max) limit insures that  $t_{\text{RAC}}$  (max) can be met,  $t_{\text{RCD}}$  (max) is specified as a reference point only; if  $t_{\text{RCD}} \geq t_{\text{RCD}} (\text{max}) + t_{\text{AA}} (\text{max}) - t_{\text{CAC}} (\text{max})$ , then access time is controlled exclusively by  $t_{\text{CAC}}$ .
  4. Operation with the  $t_{\text{RAD}}$  (max) limit insures that  $t_{\text{RAC}}$  (max) can be met,  $t_{\text{RAD}}$  (max) is specified as a reference point only; if  $t_{\text{RAD}}$  is greater than the specified  $t_{\text{RAD}}$  (max) limit, then access time is controlled exclusively by  $t_{\text{AA}}$ .
  5.  $V_{\text{IH}}$  (min) and  $V_{\text{IL}}$  (max) are reference levels for measuring timing of input signals. Also, transition times are measured between  $V_{\text{IH}}$  (min) and  $V_{\text{IL}}$  (max).
  6. Assumes that  $t_{\text{RCD}} \leq t_{\text{RCD}} (\text{max})$  and  $t_{\text{RAD}} \leq t_{\text{RAD}} (\text{max})$ . If  $t_{\text{RCD}}$  or  $t_{\text{RAD}}$  is greater than the maximum recommended value shown in this table,  $t_{\text{RAC}}$  exceeds the value shown.
  7. Measured with a load circuit equivalent to 1 TTL loads and 100 pF.
  8. Assumes that  $t_{\text{RCD}} \geq t_{\text{RCD}} (\text{max})$  and  $t_{\text{RCD}} + t_{\text{CAC}} (\text{max}) \geq t_{\text{RAD}} + t_{\text{AA}} (\text{max})$ .
  9. Assumes that  $t_{\text{RAD}} \geq t_{\text{RAD}} (\text{max})$  and  $t_{\text{RCD}} + t_{\text{CAC}} (\text{max}) \leq t_{\text{RAD}} + t_{\text{AA}} (\text{max})$ .
  10. Either  $t_{\text{RCH}}$  or  $t_{\text{RRH}}$  must be satisfied for a read cycles.
  11.  $t_{\text{OFF}}$  (max) defines the time at which the outputs achieve the open circuit condition and are not referred to output voltage levels.
  12. Early write cycle only ( $t_{\text{WCS}} \geq t_{\text{WCS}} (\text{min})$ ).
  13. These parameters are referred to  $\overline{\text{CAS}}$  leading edge in early write cycles.
  14.  $t_{\text{RASP}}$  defines  $\overline{\text{RAS}}$  pulse width in EDO page mode cycles.
  15. Access time is determined by the longest among  $t_{\text{AA}}$ ,  $t_{\text{CAC}}$  and  $t_{\text{CPA}}$ .
  16.  $t_{\text{HPC}}$  (min) can be achieved during a series of EDO page mode write cycles or EDO page mode read cycles.
  17. When output buffers are enabled once, sustain the low impedance state until valid data is obtained. When output buffer is turned on and off within a very short time, generally it causes large  $V_{\text{CC}} / V_{\text{SS}}$  line noise, which causes to degrade  $V_{\text{IH}}$  min./  $V_{\text{IL}}$  max level.
  18. All the  $V_{\text{CC}}$  and  $V_{\text{SS}}$  pins shall be supplied with the same voltages.
  19. Data output turns off and becomes high impedance from later rising edge of  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$ . Hold time and turn off time are specified by the timing specifications of later rising edge of  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  between  $t_{\text{OHR}}$  and  $t_{\text{OH}}$ , and between  $t_{\text{OFR}}$  and  $t_{\text{OFF}}$ .
  20. Please do not use  $t_{\text{RASS}}$  timing,  $10 \mu\text{s} \leq t_{\text{RASS}} \leq 100 \mu\text{s}$ . During this period, the device is in transition state from normal operation mode to self refresh mode. If  $t_{\text{RASS}} \geq 100 \mu\text{s}$ , then  $\overline{\text{RAS}}$  precharge time should use  $t_{\text{RPS}}$  instead of  $t_{\text{RP}}$ .
  21. If you use distributed CBR refresh mode with 15.6  $\mu$ s interval in normal read/write cycle, CBR refresh should be executed within 15.6  $\mu$ s immediately after exiting from and before entering into self refresh mode.
  22. If you use  $\overline{\text{RAS}}$  only refresh or CBR burst refresh mode in normal read/write cycle, 2048 cycles of distributed CBR refresh with 15.6  $\mu$ s interval should be executed within 32 ms immediately after exiting from and before entering into the self refresh mode.
  23. XXX: H or L (H:  $V_{\text{IH}} (\text{min}) \leq V_{\text{IN}} \leq V_{\text{IH}} (\text{max})$ , L:  $V_{\text{IL}} (\text{min}) \leq V_{\text{IN}} \leq V_{\text{IL}} (\text{max})$ )  
/////: Invalid Dout  
When the address, clock and input pins are not described on timing waveforms, their pins must be applied  $V_{\text{IH}}$  or  $V_{\text{IL}}$ .

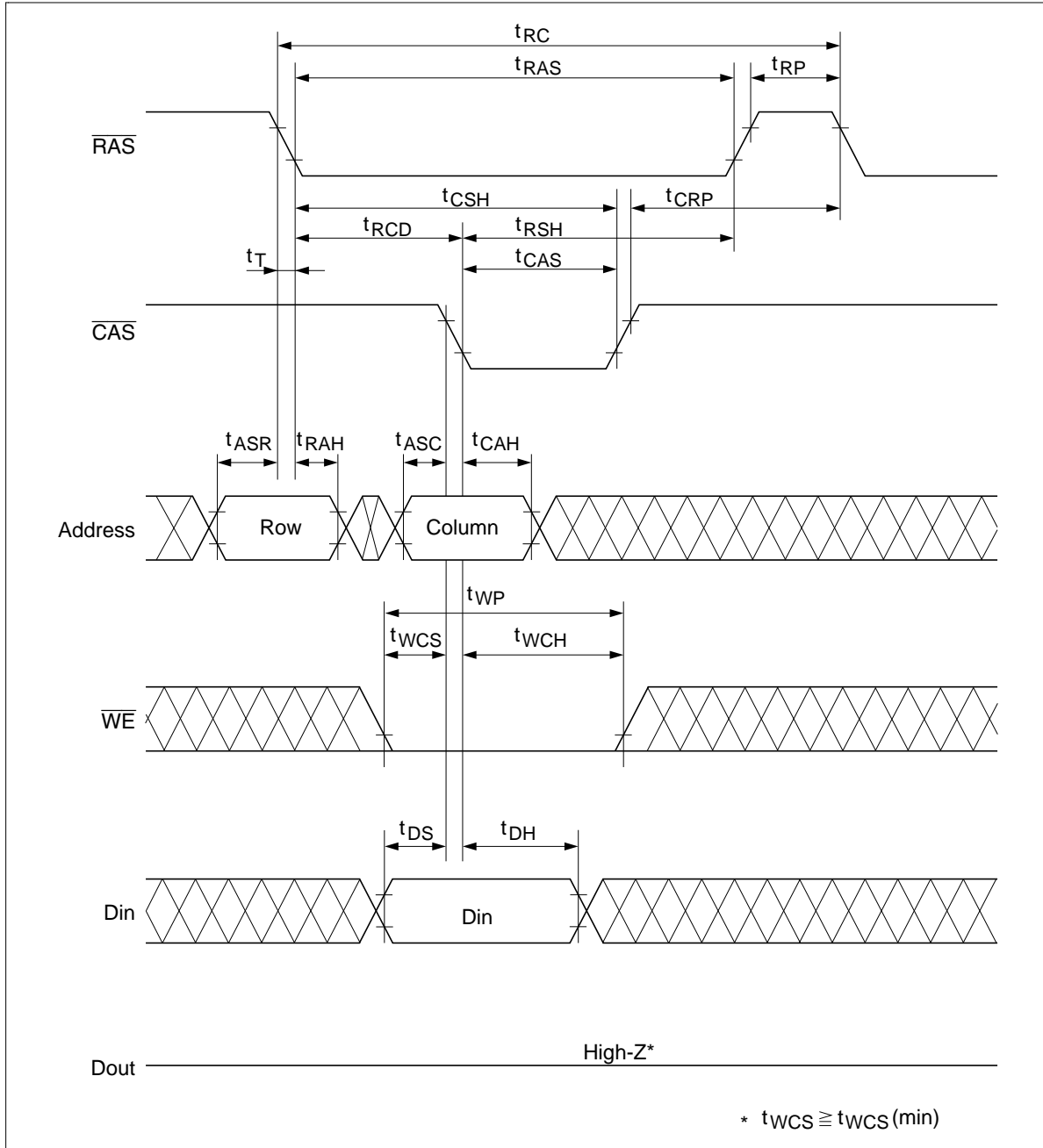
Timing Waveforms\*23

Read Cycle

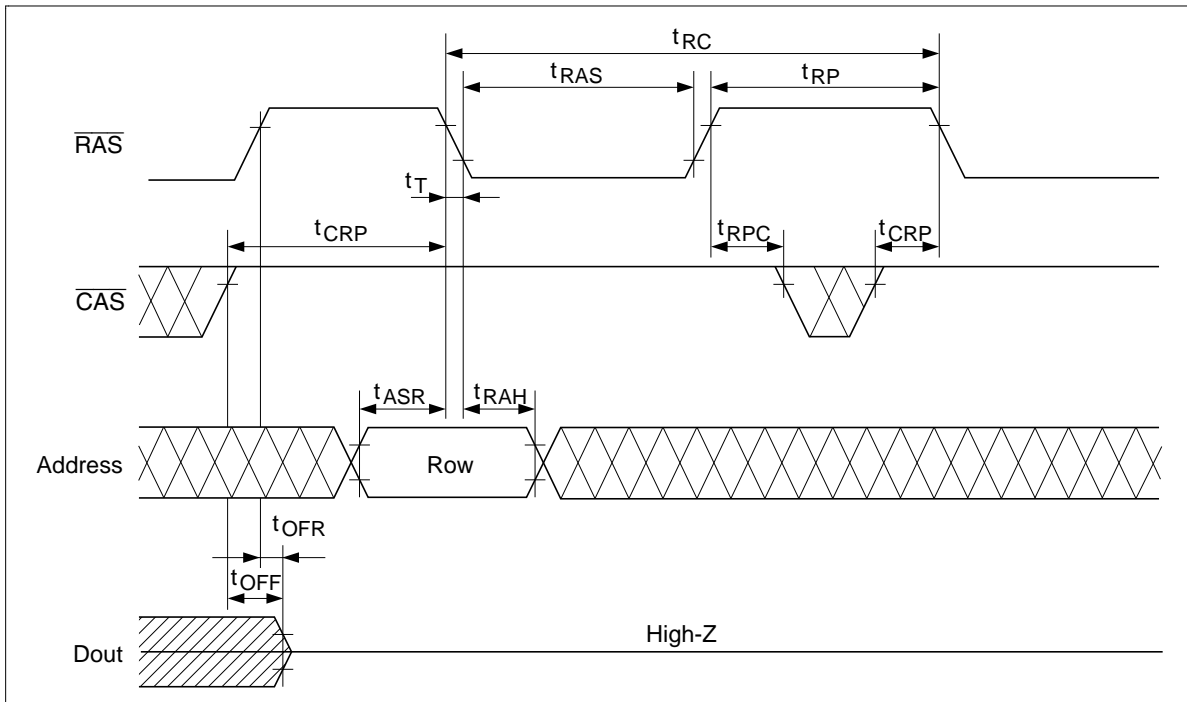


# HB56SW832DZJ Series

## Early Write Cycle

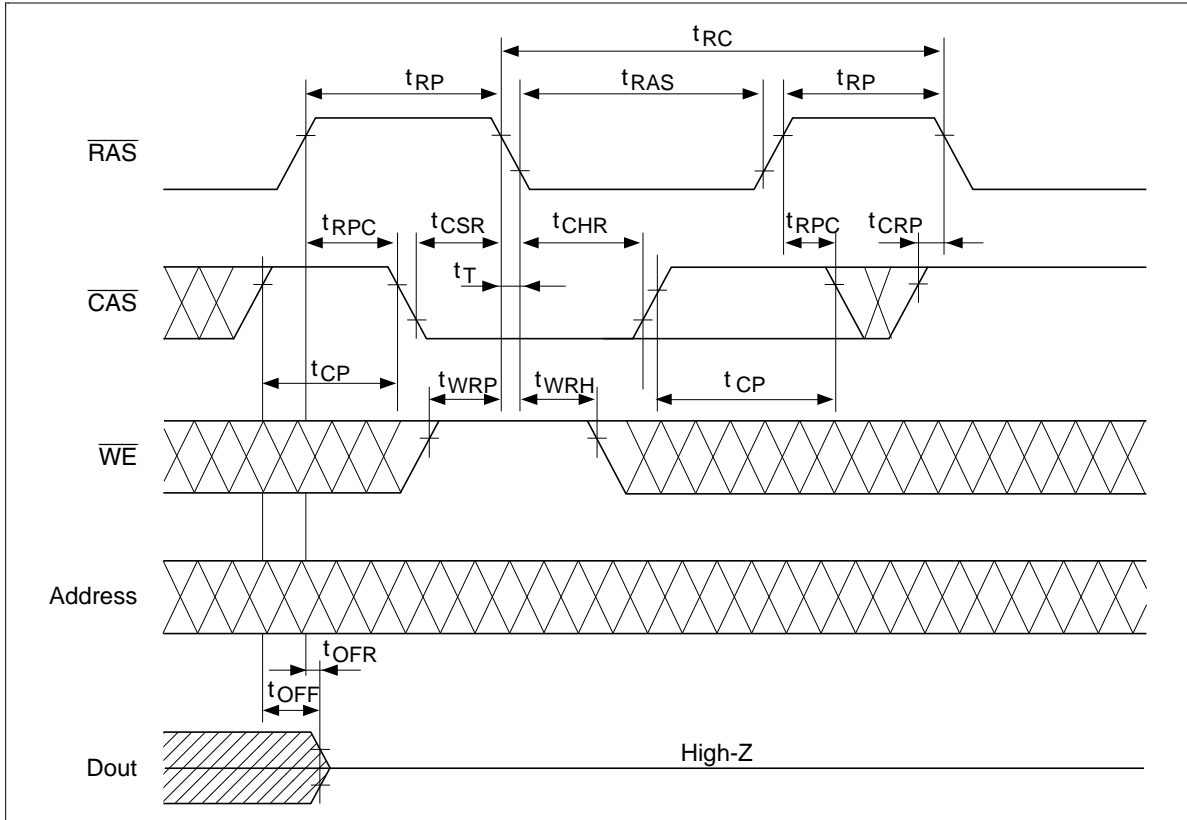


**RAS-Only Refresh Cycle**



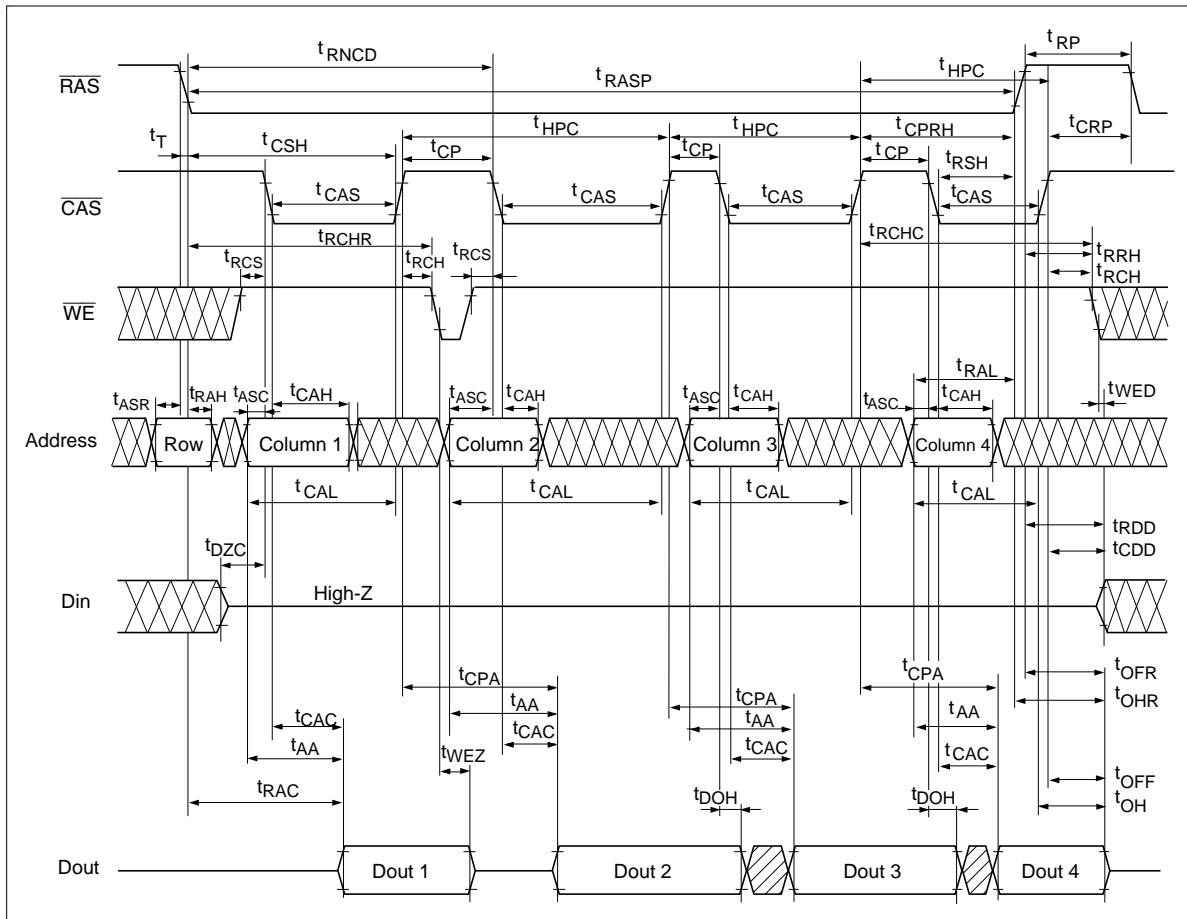
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## $\overline{\text{CAS}}$ -Before- $\overline{\text{RAS}}$ Refresh Cycle



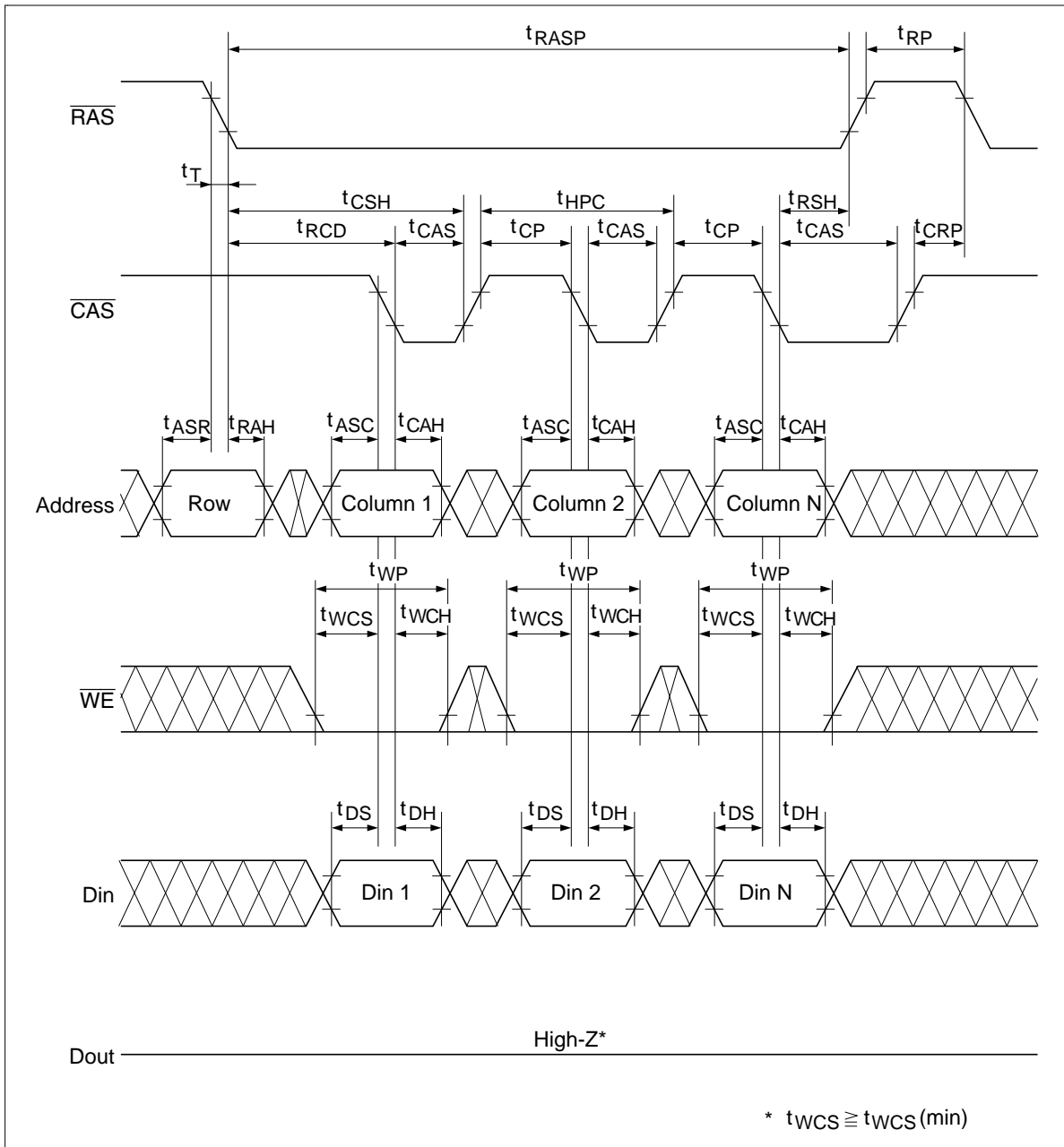


**EDO Page Mode Read Cycle**

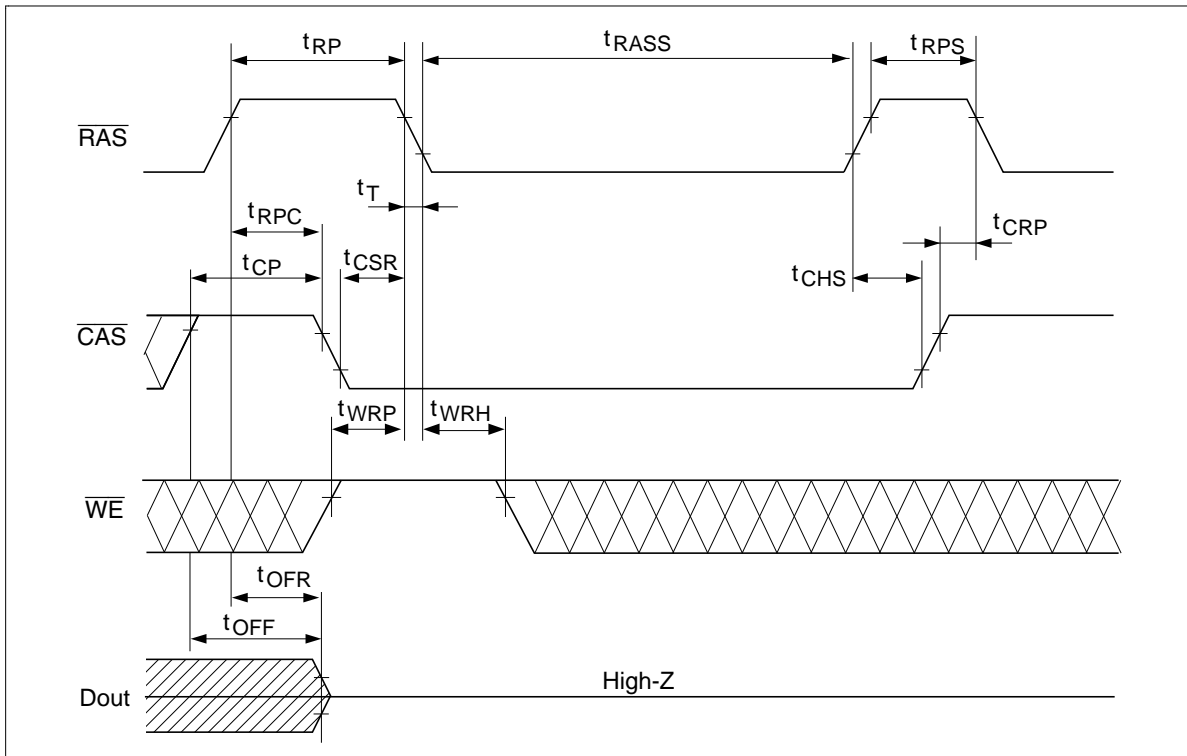


# HB56SW832DZJ Series

## EDO Page Mode Early Write Cycle

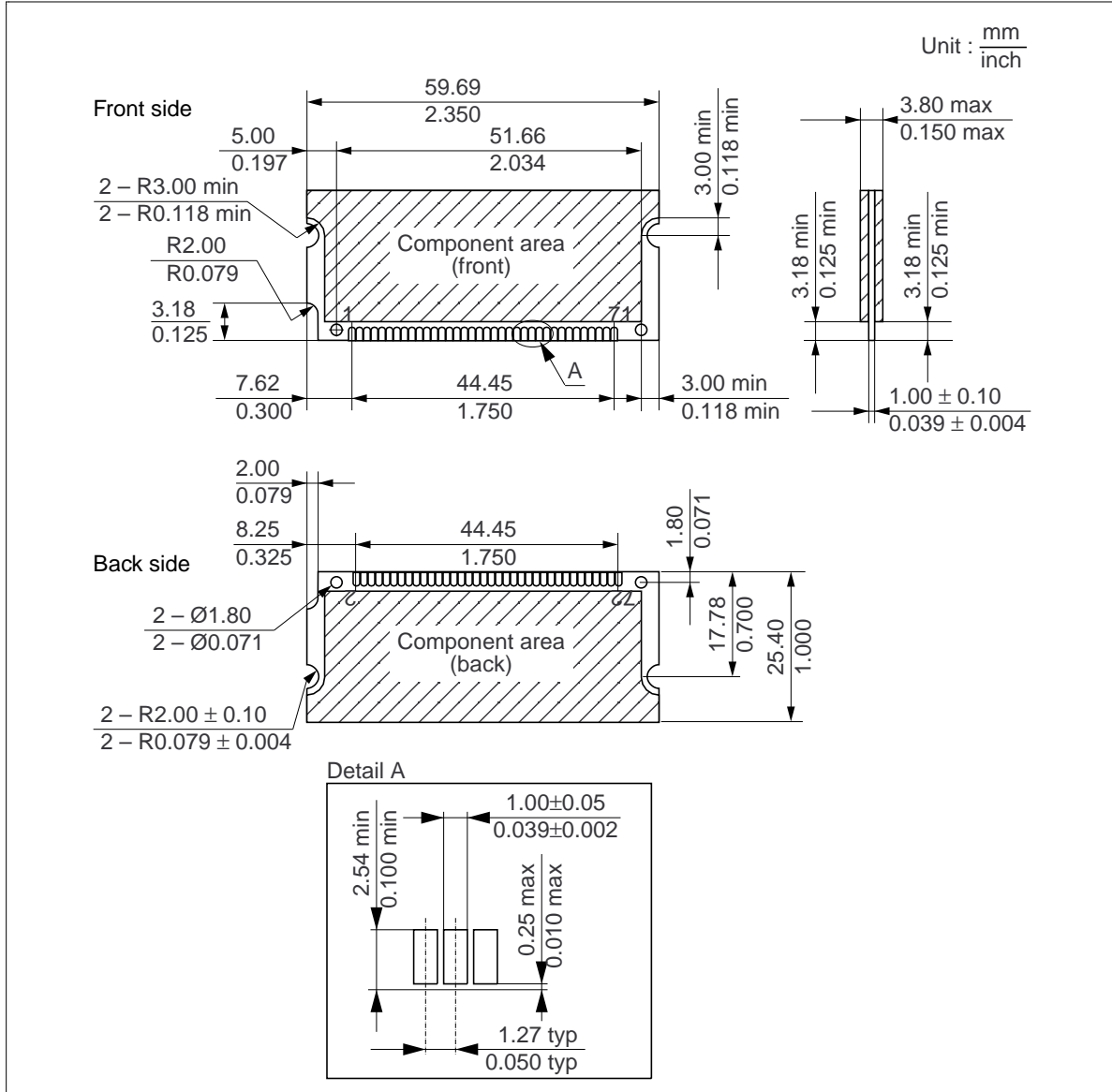


Self Refresh Cycle (LS-version)\*20, 21, 22



# HB56SW832DZJ Series

## Physical Outline



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## **HB56SW832DZJ Series**

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