
HB56U832B/SB-6BN/7BN/8BN

8,388,608-word $\times$ 32-bit High Density Dynamic RAM Module

HITACHI

ADE-203-557(Z)
Preliminary - Rev.0.0
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Description

The HB56U832 is a $8M \times 32$ dynamic RAM module, mounted 16 pieces of 16-Mbit DRAM (HM5117405BS) sealed in SOJ package.

An outline of the HB56U832 is 72-pin single in-line package.

The HB56U832 offers Extended Data Out (EDO) Page Mode as a high speed access mode.

Therefore, the HB56U832 makes high density mounting possible without surface mount technology. The HB56U832 provides common data inputs and outputs.

Decoupling capacitors are mounted beneath each SOJ on the module board.

Features

- 72-pin single in-line package
 - Lead pitch: 1.27 mm
- Single 5 V ($\pm 5\%$) supply
- High speed
 - Access time: $t_{RAC} = 60/70/80$ ns (max)
 - Access time: $t_{CAC} = 15/18/20$ ns (max)
- Low power dissipation
 - Active mode: 4.83/4.41/3.99 W (max)
 - Standby mode (TTL): 168 mW (max)
 - Standby mode (CMOS): 84 mW (max)
- EDO mode capability
- 2,048 refresh cycle: 32 ms
- 3 variations of refresh
 - $\overline{RAS}$ -only refresh
 - $\overline{CAS}$ -before- $\overline{RAS}$ refresh
 - Hidden refresh
- TTL compatible

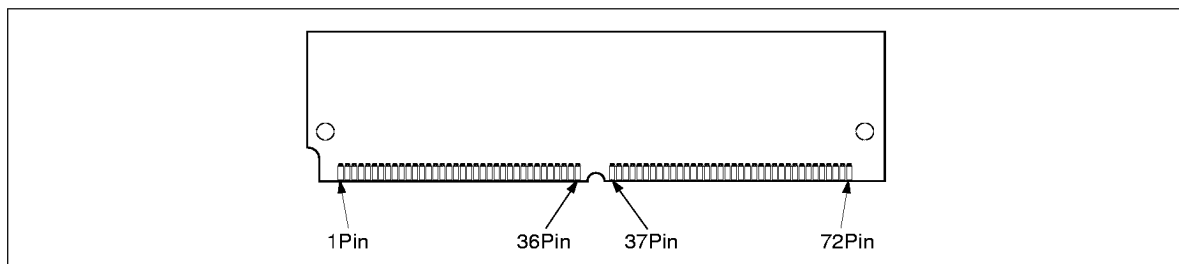
Preliminary: This document contains information on a new product. Specifications and information contained herein are subject to change without notice.

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Ordering Information

Type No.	Access time	Package	Contact pad
HB56U832B-6BN	60 ns	72-pin SIP socket type	Gold
HB56U832B-7BN	70 ns	72-pin SIP socket type	Gold
HB56U832B-8BN	80 ns	72-pin SIP socket type	Gold
HB56U832SB-6BN	60 ns	72-pin SIP socket type	Solder
HB56U832SB-7BN	70 ns	72-pin SIP socket type	Solder
HB56U832SB-8BN	80 ns	72-pin SIP socket type	Solder

Pin Arrangement



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Pin Arrangement

Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	V _{SS}	19	A10	37	NC	55	DQ11
2	DQ0	20	DQ4	38	NC	56	DQ27
3	DQ16	21	DQ20	39	V _{SS}	57	DQ12
4	DQ1	22	DQ5	40	$\overline{\text{CAS0}}$	58	DQ28
5	DQ17	23	DQ21	41	$\overline{\text{CAS2}}$	59	V _{CC}
6	DQ2	24	DQ6	42	$\overline{\text{CAS3}}$	60	DQ29
7	DQ18	25	DQ22	43	$\overline{\text{CAS1}}$	61	DQ13
8	DQ3	26	DQ7	44	$\overline{\text{RAS0}}$	62	DQ30
9	DQ19	27	DQ23	45	$\overline{\text{RAS1}}$	63	DQ14
10	V _{CC}	28	A7	46	NC	64	DQ31
11	NC	29	NC	47	$\overline{\text{WE}}$	65	DQ15
12	A0	30	V _{CC}	48	NC	66	PD5
13	A1	31	A8	49	DQ8	67	PD1
14	A2	32	A9	50	DQ24	68	PD2
15	A3	33	$\overline{\text{RAS3}}$	51	DQ9	69	PD3
16	A4	34	$\overline{\text{RAS2}}$	52	DQ25	70	PD4
17	A5	35	NC	53	DQ10	71	NC
18	A6	36	NC	54	DQ26	72	V _{SS}

Pin Description

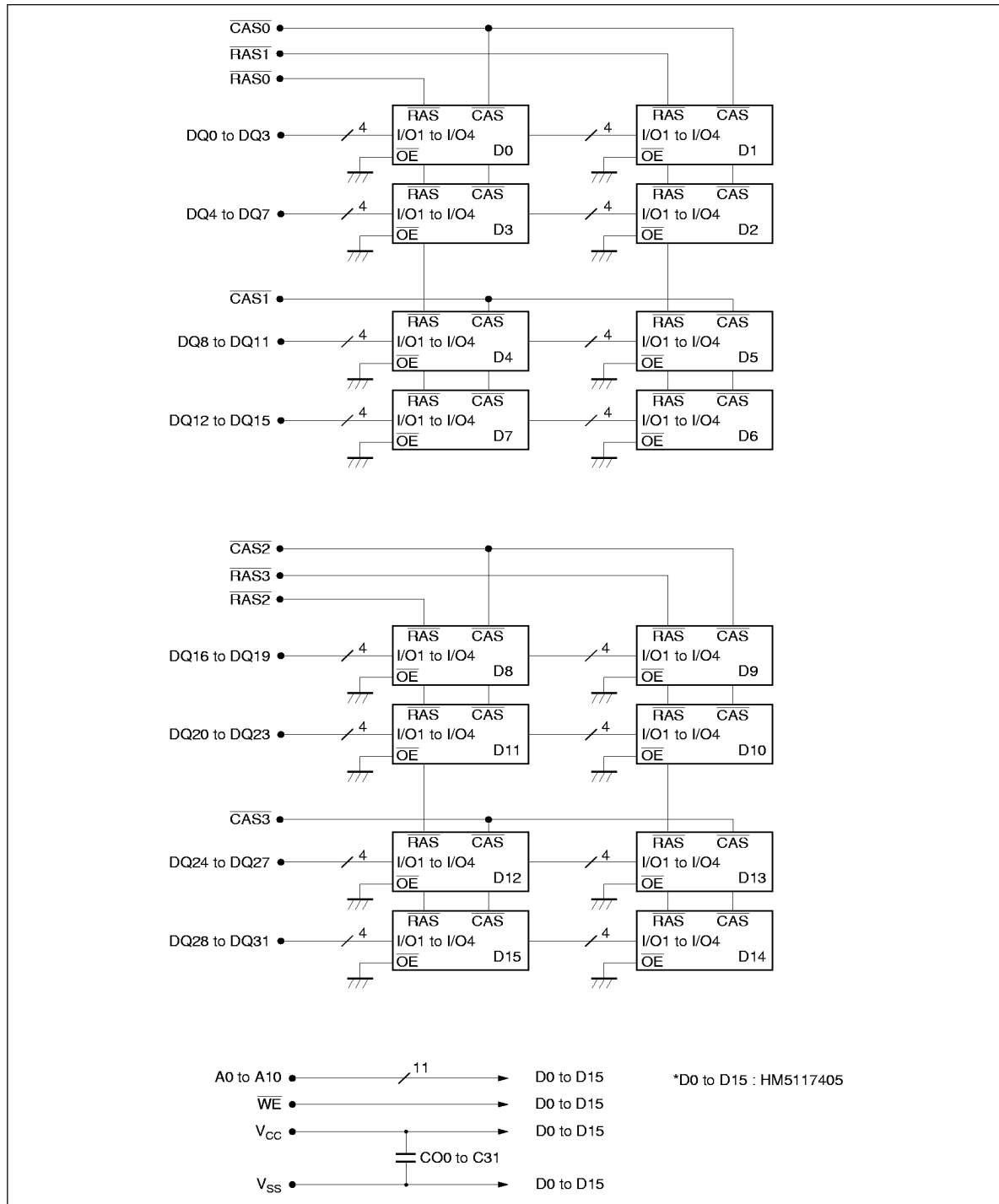
Pin Name	Function
A0 to A10	Address Input: A0 to A10 Row Address: A0 to A10 Column Address: A0 to A10 Refresh Address: A0 to A10
DQ0 to DQ31	Data-in/Data-out
$\overline{\text{RAS0}}$, $\overline{\text{RAS2}}$	Row Address Strobe
$\overline{\text{CAS0}}$ to $\overline{\text{CAS3}}$	Column Address Strobe
$\overline{\text{WE}}$	Read/Write Enable
V _{CC}	Power Supply (+5 V)
V _{SS}	Ground
PD1 to PD5	Presence detect pin
NC	Non Connection

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Presence Detect Pin Arrangement

Pin No.	Pin Name	60 ns	70 ns	80 ns
67	PD1	NC	NC	NC
68	PD2	V _{SS}	V _{SS}	V _{SS}
69	PD3	NC	V _{SS}	NC
70	PD4	NC	NC	V _{SS}
66	PD5	NC	NC	NC

Block Diagram



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Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Voltage on any pin relative to V_{SS} (Input)	V _{in}	−1.0 to +7.0	V
Voltage on any pin relative to V_{SS} (Output)	V _{out}	−1.0 to +7.0	V
Supply voltage relative to V_{SS}	V _{CC}	−1.0 to +7.0	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

Electrical Characteristics

Recommended DC Operating Conditions (T_a = 0 to 70°C)

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply voltage	V _{SS}	0	0	0	V	
Supply voltage	V _{CC}	4.75	5.0	5.25	V	1
Input high voltage	V _{IH}	2.4	—	5.5	V	1
Input low voltage	V _{IL}	−1.0	—	0.8	V	1

Note: 1. All voltage referenced to V_{SS} .

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DC Characteristics ($T_a = 0 \text{ to } 70^\circ\text{C}$, $V_{CC} = 5 \text{ V} \pm 5\%$, $V_{SS} = 0 \text{ V}$)

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Test condition	Note
		Min	Max	Min	Max	Min	Max			
Operating current	I_{CC1}	—	920	—	840	—	760	mA	$t_{RC} = \min$	1, 2
Standby current	I_{CC2}	—	32	—	32	—	32	mA	TTL interface $\overline{RAS}, \overline{CAS} = V_{IH}$ Dout = High-Z	
		—	16	—	16	—	16	mA	CMOS interface $\overline{RAS}, \overline{CAS} \geq V_{CC} - 0.2 \text{ V}$ Dout = High-Z	
$\overline{RAS}$ -only refresh current	I_{CC3}	—	920	—	840	—	760	mA	$t_{RC} = \min$	2
Standby current	I_{CC5}	—	80	—	80	—	80	mA	$\overline{RAS} = V_{IH}$ $\overline{CAS} = V_{IL}$ Dout = enable	1
$\overline{CAS}$ -before- $\overline{RAS}$ refresh current	I_{CC6}	—	920	—	840	—	760	mA	$t_{RC} = \min$	
EDO page mode current	I_{CC7}	—	920	—	840	—	760	mA	$t_{HPC} = \min$	1, 3
Input leakage current	I_{LI}	-10	10	-10	10	-10	10	μA	$0 \text{ V} \leq V_{in} \leq 7.0 \text{ V}$	
Output leakage current	I_{LO}	-10	10	-10	10	-10	10	μA	$0 \text{ V} \leq V_{out} \leq 7.0 \text{ V}$ Dout = disable	
Output high voltage	V_{OH}	2.4	V_{CC}	2.4	V_{CC}	2.4	V_{CC}	V	High Iout = -2 mA	
Output low voltage	V_{OL}	0	0.4	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 $\overline{RAS} = V_{IL}$.

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

Capacitance ($T_a = 25^\circ\text{C}$, $V_{CC} = 5 \text{ V} \pm 5\%$)

Parameter	Symbol	Typ	Max	Unit	Notes
Input capacitance (Address)	C_{I1}	—	95	pF	1
Input capacitance ($\overline{WE}$)	C_{I2}	—	127	pF	1
Input capacitance ($\overline{RAS}$)	C_{I3}	—	43	pF	1
Input capacitance ($\overline{CAS}$)	C_{I4}	—	43	pF	1
I/O capacitance (DQ)	$C_{I/O}$	—	29	pF	1, 2

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

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

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AC Characteristics ($T_a = 0$ to 70°C , $V_{CC} = 5\text{ V} \pm 5\%$, $V_{SS} = 0\text{ V}$) *¹, *²

Test Conditions

- Input rise and fall times: 2 ns
- Input levels: $V_{IL} = 0\text{ V}$, $V_{IH} = 3\text{ V}$
- Input timing reference levels: 0.8 V, 2.4 V
- Output timing reference levels: 0.8 V, 2.0 V
- Output load: 1 TTL gate + C_L (100 pF) (Including scope and jig)

Read, Write and Refresh Cycles (Common parameters)

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Random read or write cycle time	t_{RC}	104	—	124	—	144	—	ns	
$\overline{\text{RAS}}$ precharge time	t_{RP}	40	—	50	—	60	—	ns	
$\overline{\text{CAS}}$ precharge time	t_{CP}	10	—	13	—	15	—	ns	
$\overline{\text{RAS}}$ pulse width	t_{RAS}	60	10000	70	10000	80	10000	ns	
$\overline{\text{CAS}}$ pulse width	t_{CAS}	10	10000	13	10000	15	10000	ns	
Row address setup time	t_{ASR}	0	—	0	—	0	—	ns	
Row address hold time	t_{RAH}	10	—	10	—	10	—	ns	
Column address setup time	t_{ASC}	0	—	0	—	0	—	ns	
Column address hold time	t_{CAH}	10	—	13	—	15	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ delay time	t_{RCD}	20	45	20	52	20	60	ns	3
$\overline{\text{RAS}}$ to column address delay time	t_{RAD}	15	30	15	35	15	40	ns	4
$\overline{\text{RAS}}$ hold time	t_{RSH}	15	—	18	—	20	—	ns	
$\overline{\text{CAS}}$ hold time	t_{CSH}	48	—	58	—	68	—	ns	
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ precharge time	t_{CRP}	5	—	5	—	5	—	ns	
$\overline{\text{CAS}}$ delay time from D_{in}	t_{DZC}	0	—	0	—	0	—	ns	
Transition time (rise and fall)	t_T	2	50	2	50	2	50	ns	5
Refresh period (2,048 cycle)	t_{REF}	—	32	—	32	—	32	ms	

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Read Cycles

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Access time from $\overline{\text{RAS}}$	t_{RAC}	—	60	—	70	—	80	ns	6, 7
Access time from $\overline{\text{CAS}}$	t_{CAC}	—	15	—	18	—	20	ns	7, 8, 15
Access time from address	t_{AA}	—	30	—	35	—	40	ns	7, 9, 15
Read command setup time	t_{RCS}	0	—	0	—	0	—	ns	
Read command hold time to $\overline{\text{CAS}}$	t_{RCH}	0	—	0	—	0	—	ns	10
Read command hold time from $\overline{\text{RAS}}$	t_{RCHR}	60	—	70	—	80	—	ns	
Read command hold time to $\overline{\text{RAS}}$	t_{RRH}	0	—	0	—	0	—	ns	10
Column address to $\overline{\text{RAS}}$ lead time	t_{RAL}	30	—	35	—	40	—	ns	
Column address to $\overline{\text{CAS}}$ lead time	t_{CAL}	18	—	23	—	28	—	ns	
$\overline{\text{CAS}}$ to output in low-Z	t_{CLZ}	0	—	0	—	0	—	ns	
Output data hold time	t_{OH}	3	—	3	—	3	—	ns	
Output buffer turn-off time	t_{OFF}	—	15	—	15	—	15	ns	11
$\overline{\text{CAS}}$ to Din delay time	t_{CDD}	15	—	18	—	20	—	ns	
Output data hold time from $\overline{\text{RAS}}$	t_{OHR}	3	—	3	—	3	—	ns	
Output buffer turn-off to $\overline{\text{RAS}}$	t_{OFR}	—	15	—	15	—	15	ns	
Output buffer turn-off to $\overline{\text{WE}}$	t_{WEZ}	—	15	—	15	—	15	ns	
$\overline{\text{WE}}$ to Din delay time	t_{WED}	15	—	18	—	20	—	ns	
$\overline{\text{RAS}}$ to Din delay time	t_{RDD}	15	—	18	—	20	—	ns	

Write Cycles

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Write command setup time	t_{WCS}	0	—	0	—	0	—	ns	12
Write command hold time	t_{WCH}	10	—	13	—	15	—	ns	
Write command pulse width	t_{WP}	10	—	10	—	10	—	ns	
Data-in setup time	t_{DS}	0	—	0	—	0	—	ns	13
Data-in hold time	t_{DH}	10	—	13	—	15	—	ns	13

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Refresh Cycles

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Notes
		Min	Max	Min	Max	Min	Max		
$\overline{\text{CAS}}$ setup time (CBR refresh cycle)	t_{CSR}	5	—	5	—	5	—	ns	
$\overline{\text{CAS}}$ hold time (CBR refresh cycle)	t_{CHR}	10	—	10	—	10	—	ns	
$\overline{\text{WE}}$ setup time (CBR refresh cycle)	t_{WRP}	0	—	0	—	0	—	ns	
$\overline{\text{WE}}$ hold time (CBR refresh cycle)	t_{WRH}	10	—	10	—	10	—	ns	
$\overline{\text{RAS}}$ precharge to $\overline{\text{CAS}}$ hold time	t_{RPC}	0	—	0	—	0	—	ns	

Fast Page Mode Cycles

Parameter	Symbol	60 ns		70 ns		80 ns		Unit	Notes
		Min	Max	Min	Max	Min	Max		
Fast page mode cycle time	t_{HPC}	25	—	30	—	35	—	ns	16
Fast page mode $\overline{\text{RAS}}$ pulse width	t_{RASP}	—	100000	—	100000	—	100000	ns	14
Access time from $\overline{\text{CAS}}$ precharge	t_{CPA}	—	35	—	40	—	45	ns	7, 15
$\overline{\text{RAS}}$ hold time from $\overline{\text{CAS}}$ precharge	t_{CPRH}	35	—	40	—	45	—	ns	
Output data hold time from $\overline{\text{CAS}}$ low	t_{DOH}	3	—	3	—	3	—	ns	7, 15
Read command hold time from $\overline{\text{CAS}}$ precharge	t_{RCHO}	35	—	40	—	45	—	ns	

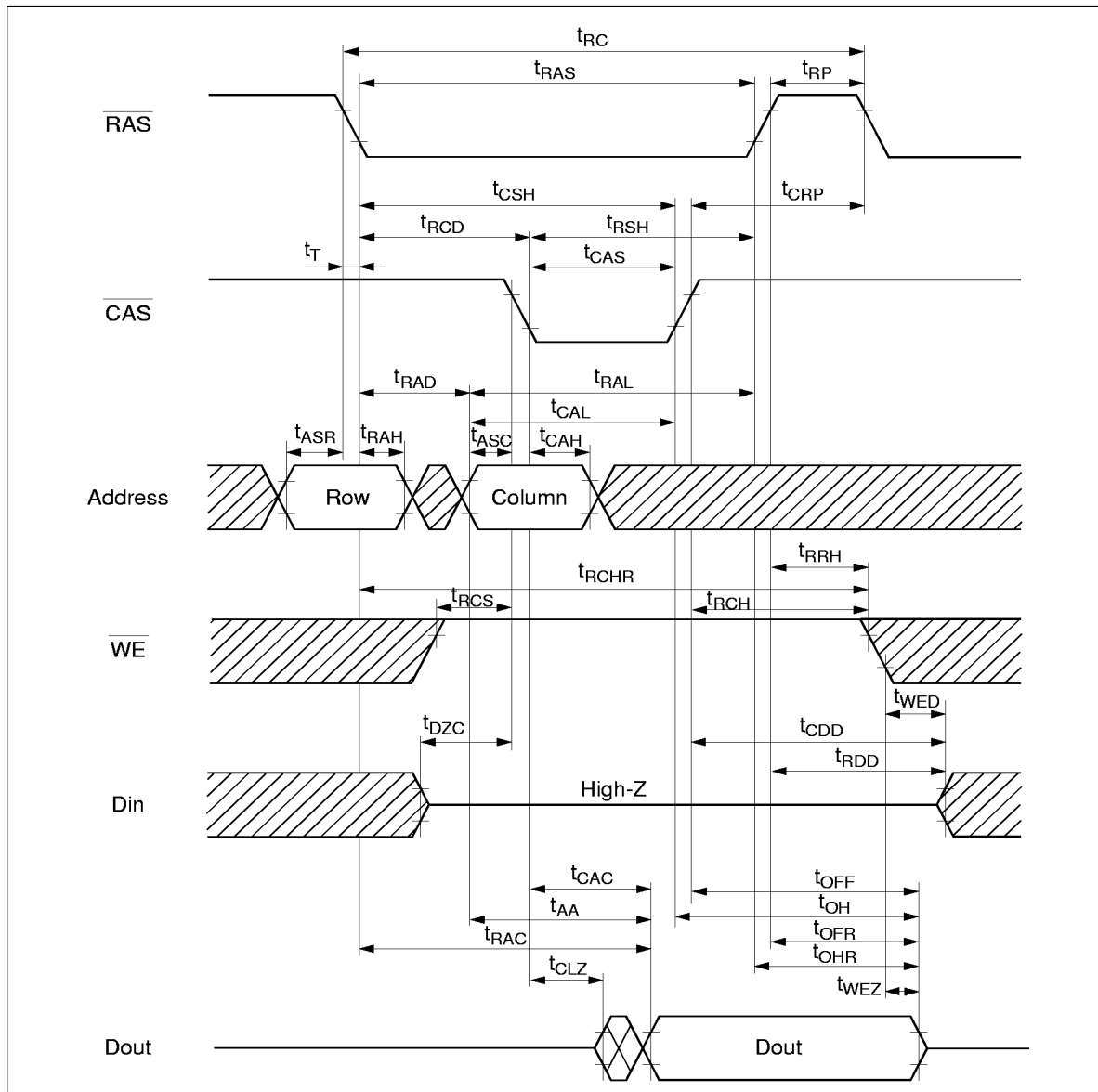
- Notes:
1. AC measurements assume $t_T = 2 \text{ ns}$.
 2. An initial pause of $200 \mu\text{s}$ is required after power up followed by a minimum of eight initialization cycles (any combination of cycles containing $\overline{\text{RAS}}$ -only refresh cycle or $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ 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_{RCD} (max) limit insures that t_{RAC} (max) can be met, t_{RCD} (max) is specified as a reference point only; if t_{RCD} is greater than the specified t_{RCD} (max) limit, then access time is controlled exclusively by t_{CAC} .
 4. Operation with the t_{RAD} (max) limit insures that t_{RAC} (max) can be met, t_{RAD} (max) is specified as a reference point only; if t_{RAD} is greater than the specified t_{RAD} (max) limit, then access time is controlled exclusively by t_{AA} .
 5. V_{IH} (min) and V_{IL} (max) are reference levels for measuring timing of input signals. Also, transition times are measured between V_{IH} (min) and V_{IL} (max).
 6. Assumes that $t_{\text{RCD}} \leq t_{\text{RCD}}$ (max) and $t_{\text{RAD}} \leq t_{\text{RAD}}$ (max). If t_{RCD} or t_{RAD} is greater than the maximum recommended value shown in this table, t_{RAC} exceeds the value shown.
 7. Measured with a load circuit equivalent to 1TTL loads and 100 pF.
 8. Assumes that $t_{\text{RCD}} \geq t_{\text{RCD}}$ (max) and $t_{\text{RCD}} + t_{\text{CAC}}$ (max) $\geq t_{\text{RAD}} + t_{\text{AA}}$ (max).
 9. Assumes that $t_{\text{RAD}} \geq t_{\text{RAD}}$ (max) and $t_{\text{RCD}} + t_{\text{CAC}}$ (max) $\leq t_{\text{RAD}} + t_{\text{AA}}$ (max).
 10. Either t_{RCH} or t_{RRH} must be satisfied for a read cycles.
 11. t_{OFF} (max) define the time at which the outputs achieve the open circuit condition and are not referenced to output voltage levels.
 12. t_{WCS} is not restrictive operating parameters. It is included in the data sheet as electrical characteristics only; if $t_{\text{WCS}} \geq t_{\text{WCS}}$ (min), the cycle is an early write cycle and the data out pin will remain open circuit (high impedance) throughout the entire cycle.
 13. These parameters are referenced to $\overline{\text{CAS}}$ leading edge in early write cycle.
 14. t_{RASp} defines $\overline{\text{RAS}}$ pulse width in EDO page mode cycles.
 15. Access time is determined by the longer of t_{AA} or t_{CAC} or t_{CPA} .
 16. t_{HPC} (min) can be achieve during a series of EDO page mode write cycles or EDO page mode read cycles.

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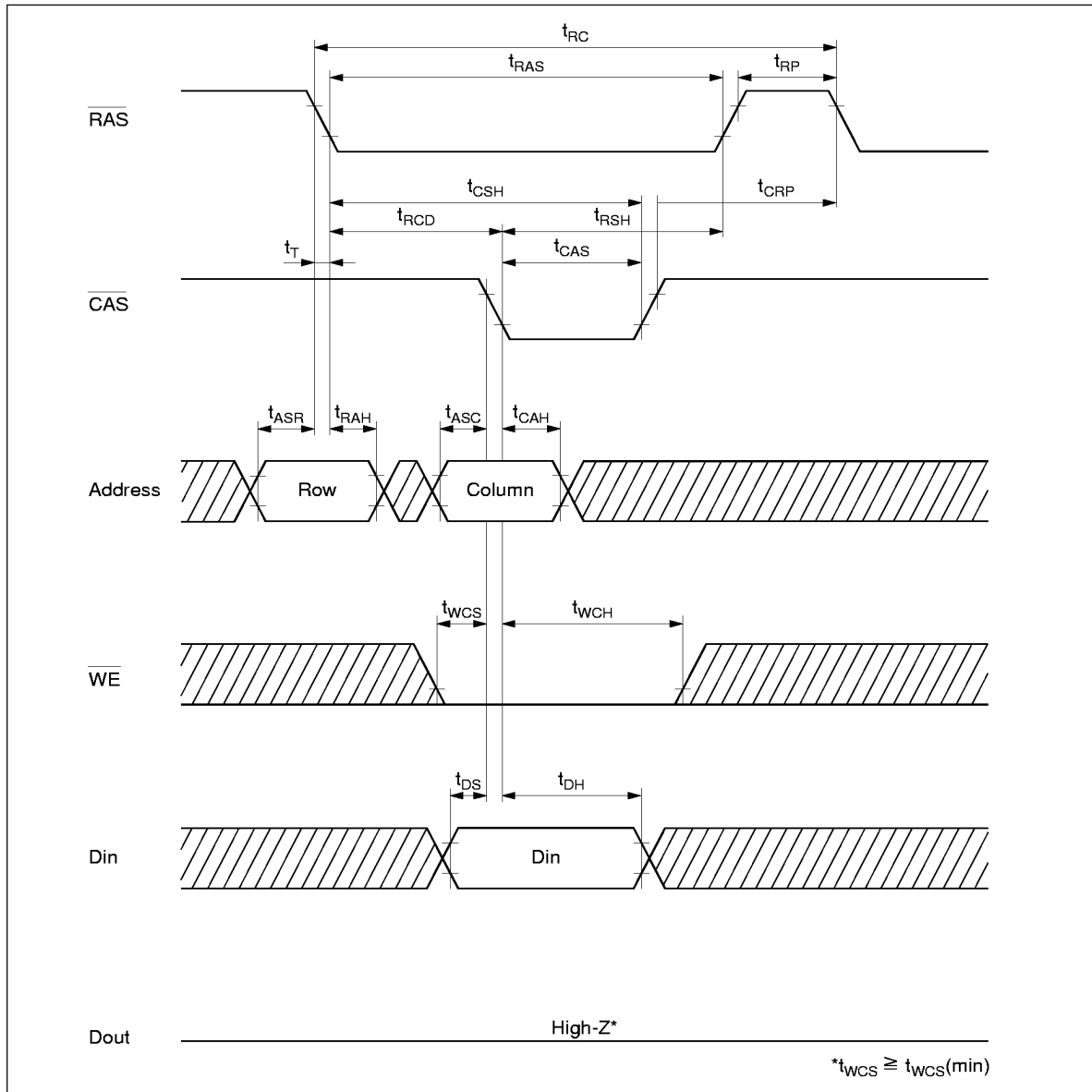
Timing Waveform

Notes: //: H or L (H: $V_{IH}(\min) \leq V_{in} \leq V_{IH}(\max)$, L: $V_{IL}(\min) \leq V_{in} \leq V_{IL}(\max)$)
 XXX: Invalid Dout

Read Cycle

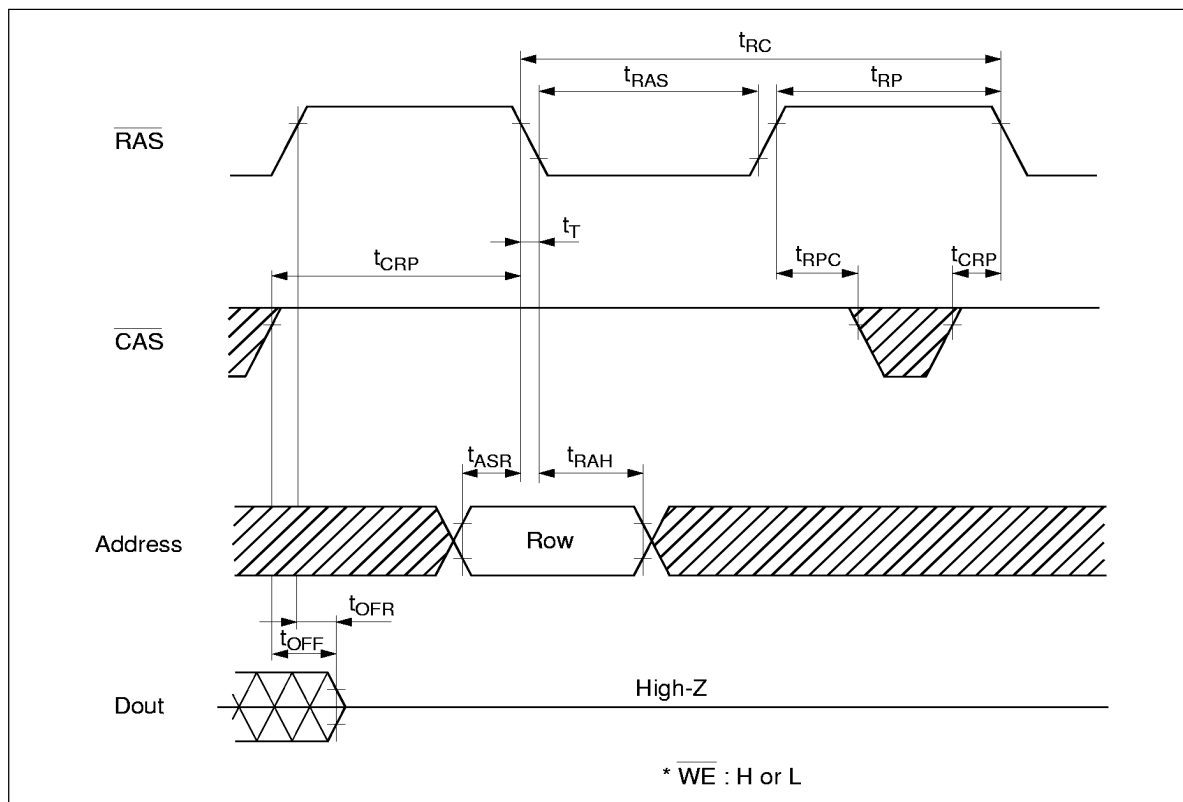


Early Write Cycle

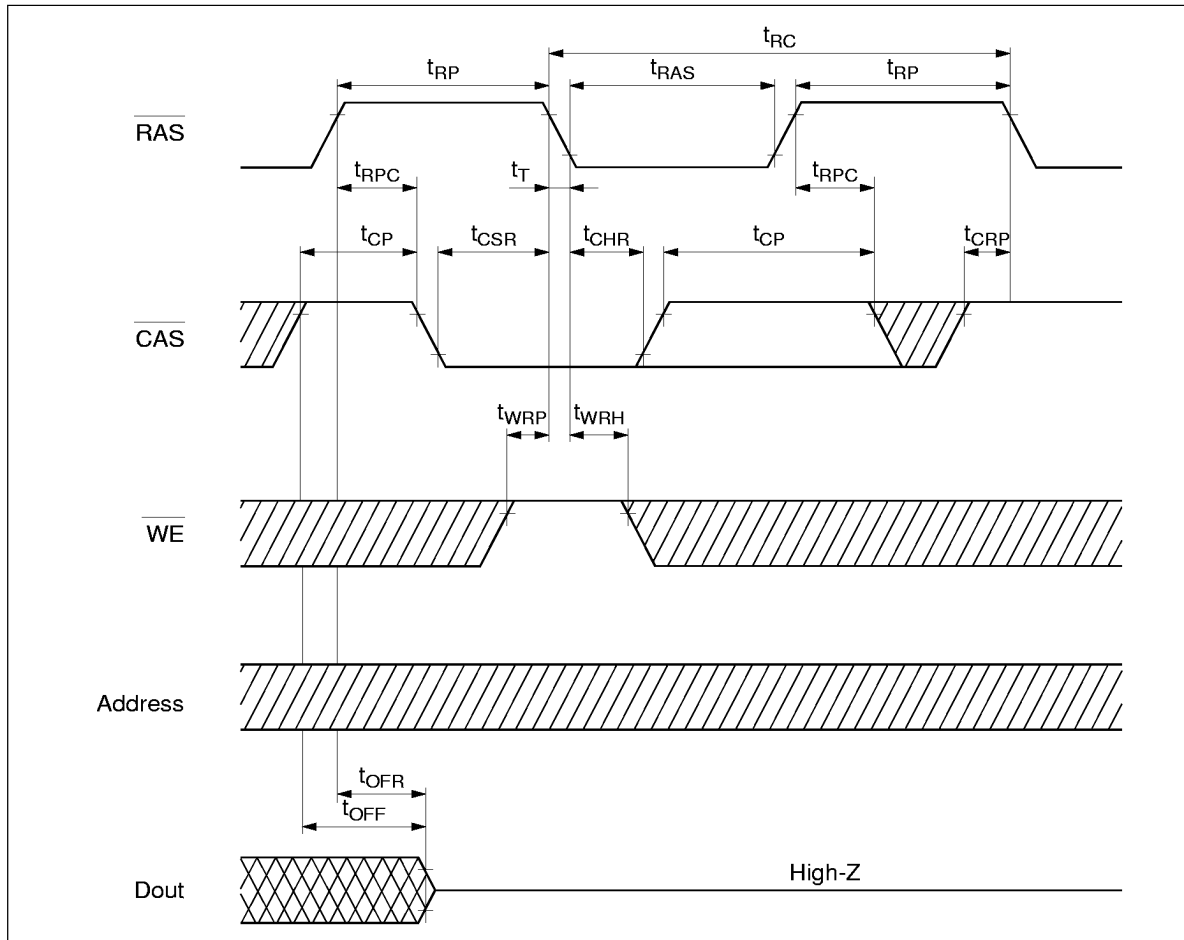


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$\overline{\text{RAS}}$ -Only Refresh Cycle

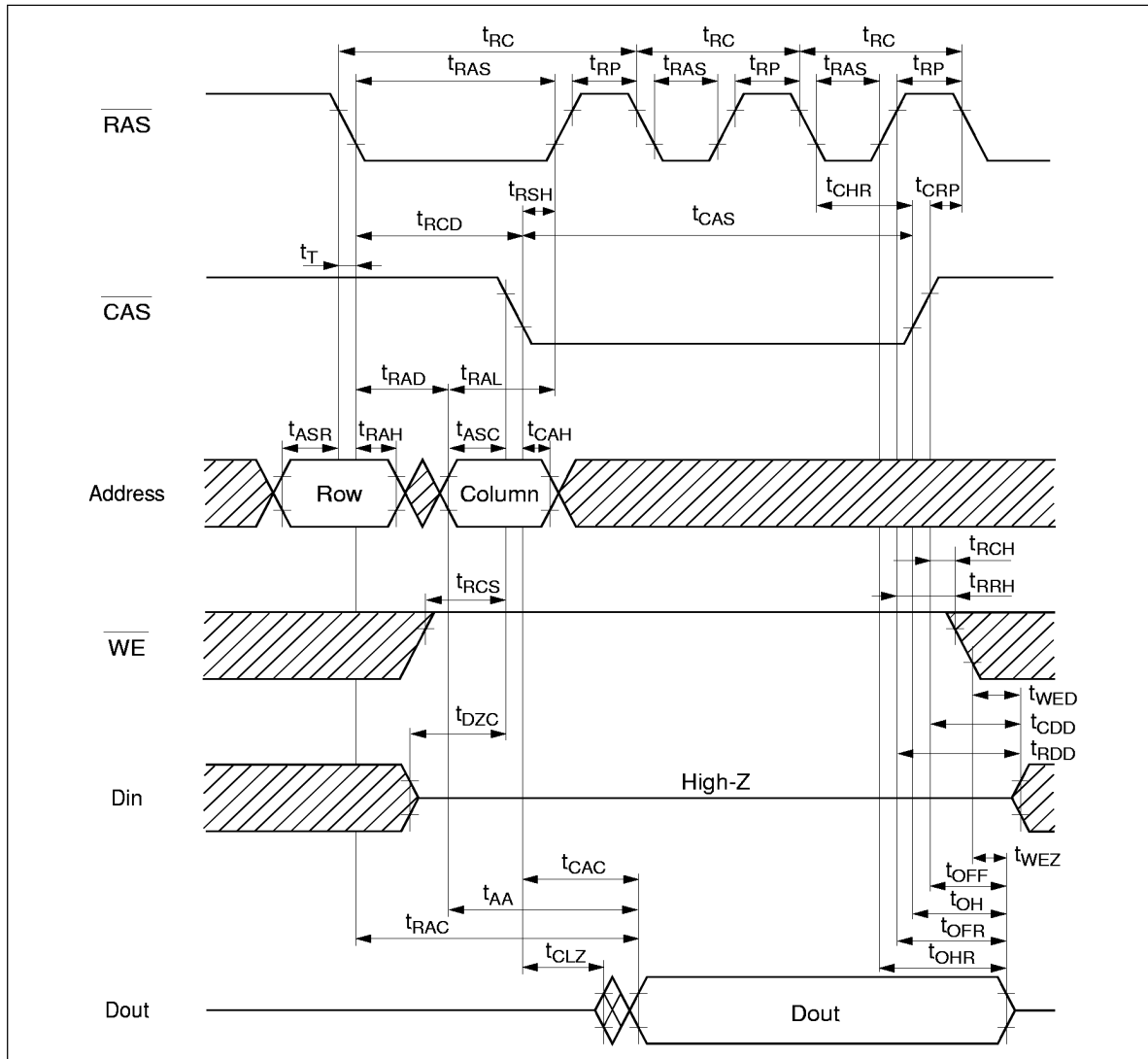


CAS-Before-RAS Refresh Cycle



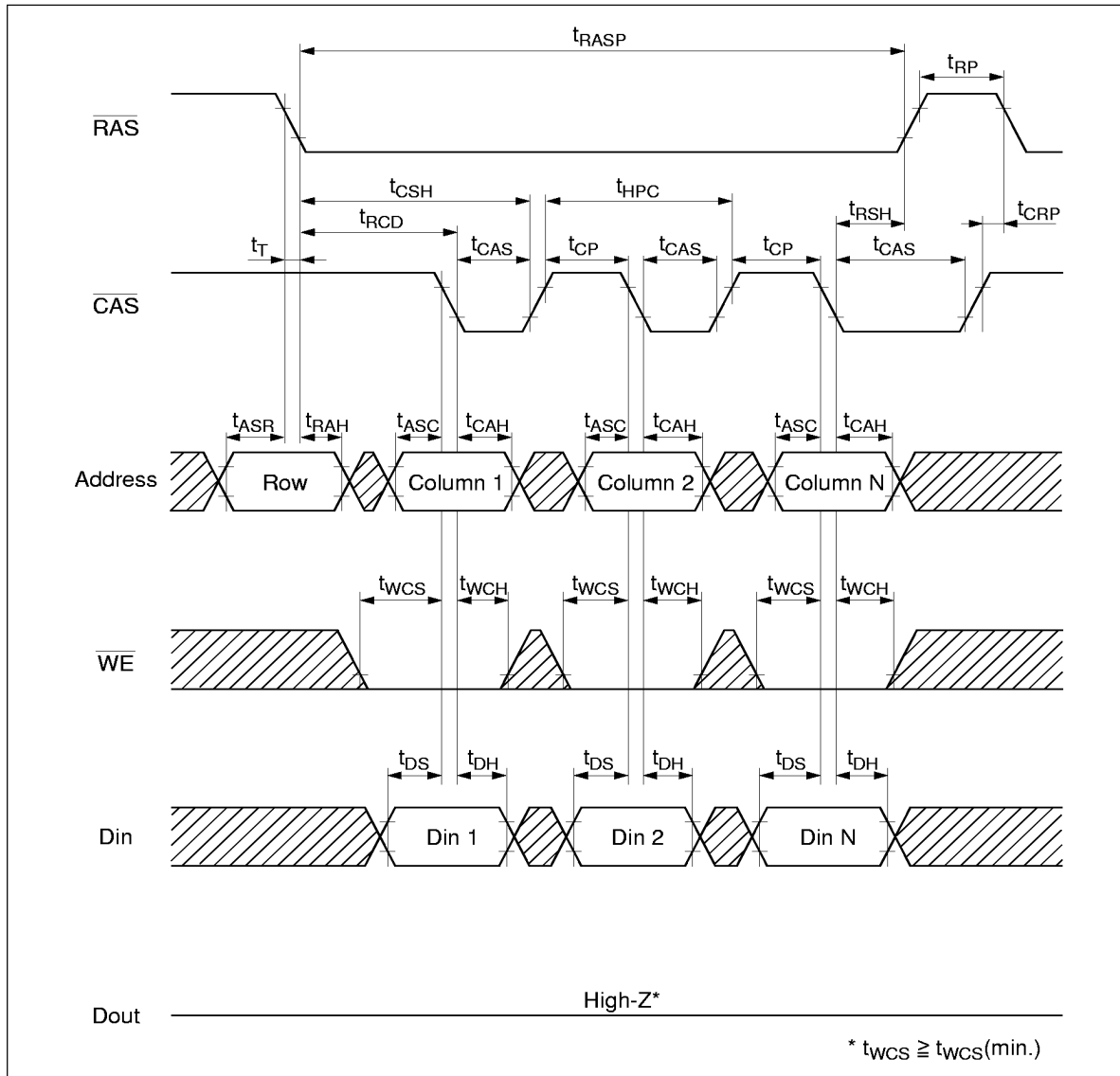
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Hidden Refresh Cycle



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EDO Page Mode Early Write Cycle

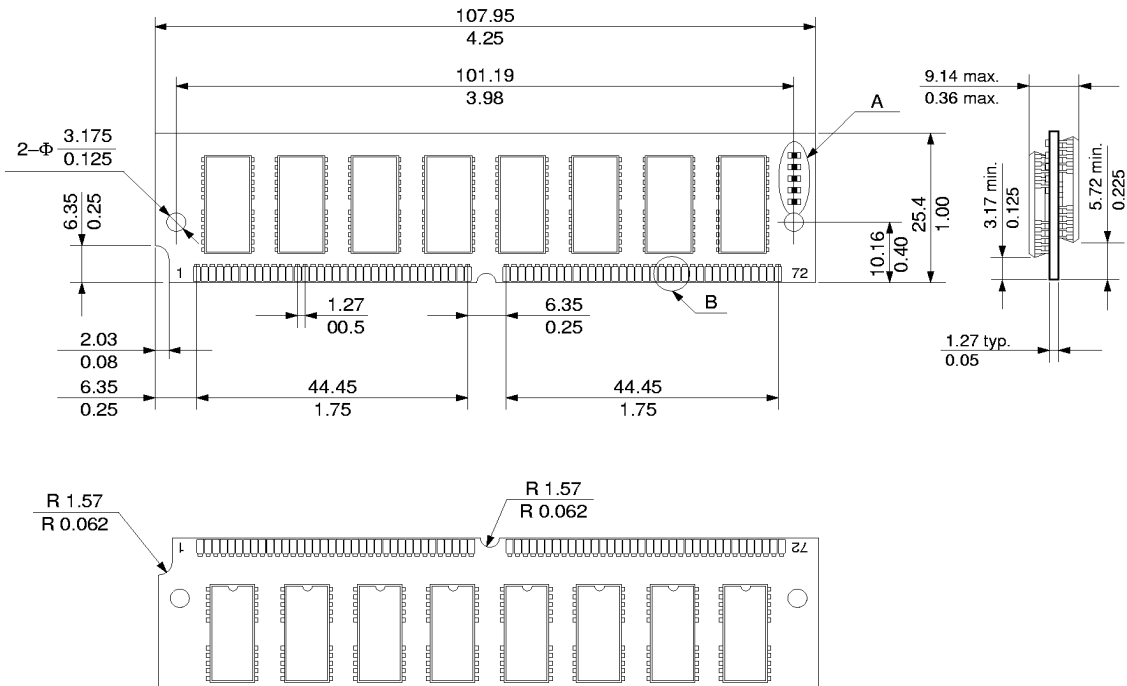


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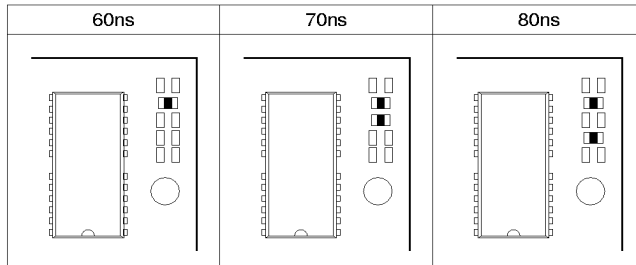
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Physical Outline

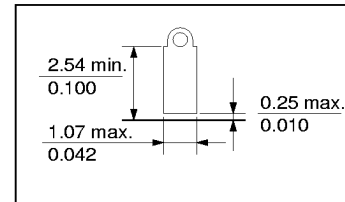
Unit: mm/inch



Detail A



Detail A



Note : Following the specification of the contact pads.

Part No.	Contact pad
HB56U832B-XX	gold
HB56U832SB-XX	solder