



LC322271J, M, T-70/80

2 MEG (131072 words × 16 bits) DRAM Fast Page Mode, Byte Write

Preliminary

Overview

The LC322271J, M and T is a CMOS dynamic RAM operating on a single 5 V power source and having a 131072 words × 16 bits configuration. Equipped with large capacity capabilities, high speed transfer rates and low power dissipation, this series is suited for a wide variety of applications ranging from computer main memory and expansion memory to commercial equipment.

Address input utilizes a multiplexed address bus which permits it to be enclosed in a compact plastic package of SOJ 40-pin, SOP 40-pin, and TSOP 44-pin. Refresh rates are within 8 ms with 512 row address (A0 to A7, A8R) selection and support Row Address Strobe ($\overline{\text{RAS}}$)-only refresh, Column Address Strobe ($\overline{\text{CAS}}$)-before- $\overline{\text{RAS}}$ refresh and hidden refresh settings. There are functions such as fast page mode, read-modify-write and byte write. The pin assignment follows the JEDEC 1 M DRAM (65536 words × 16 bits, $1\overline{\text{CAS}}/2\overline{\text{WE}}$) standard.

Features

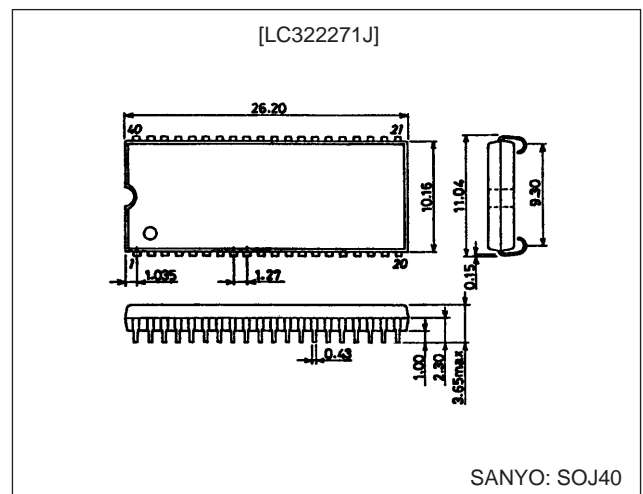
- 131072 words × 16 bits configuration.
- Single 5 V ± 10% power supply.
- All input and output (I/O) TTL compatible.
- Supports fast page mode, read-modify-write and byte write.
- Supports output buffer control using early write and Output Enable ($\overline{\text{OE}}$) control.
- 8 ms refresh using 512 refresh cycles.
- Supports $\overline{\text{RAS}}$ -only refresh, $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ refresh and hidden refresh.
- Follows the JEDEC 1 M DRAM (65536 words × 16 bits, $1\overline{\text{CAS}}/2\overline{\text{WE}}$) standard.
- $\overline{\text{RAS}}$ access time/column address time/ $\overline{\text{CAS}}$ access time/cycle time/power dissipation

- Package:
SOJ 40-pin (400 mil) plastic package : LC322271J
SOP 40-pin (450 mil) plastic package : LC322271M
TSOP 44-pin (400 mil) plastic package : LC322271T

Package Dimensions

unit: mm

3200-SOJ40



Parameter	LC322271J, M, T	
	-70	-80
RAS access time	70 ns	80 ns
Column address access time	35 ns	45 ns
$\overline{\text{CAS}}$ access time	20 ns	30 ns
Cycle time	130 ns	150 ns
Power dissipation (max.)	During operation	688 mW
	During standby	633 mW
		5.5 mW (CMOS level)/11 mW (TTL level)

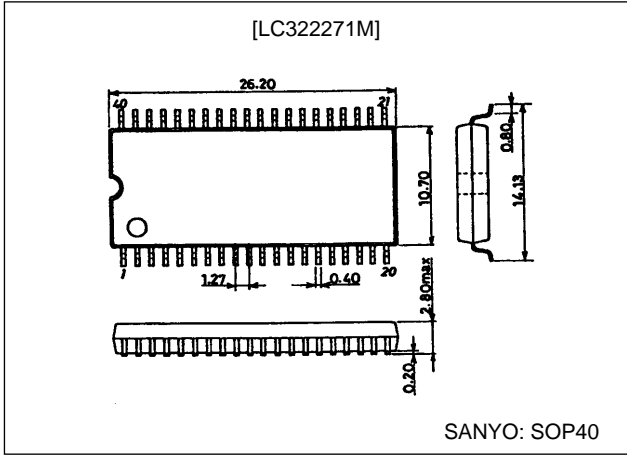
SANYO Electric Co., Ltd. Semiconductor Business Headquarters

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-0005 JAPAN

Package Dimensions

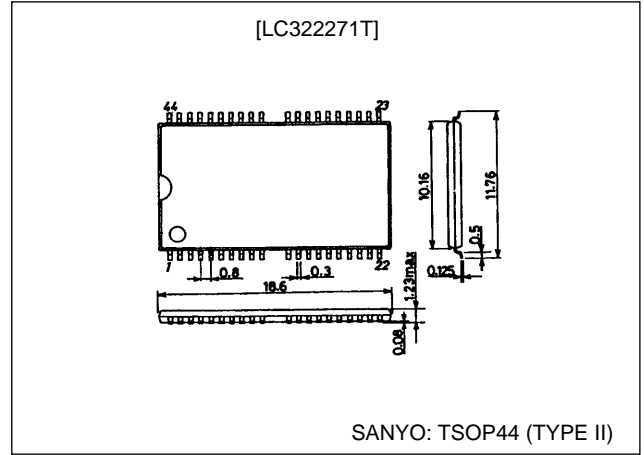
unit: mm

3195-SOP40

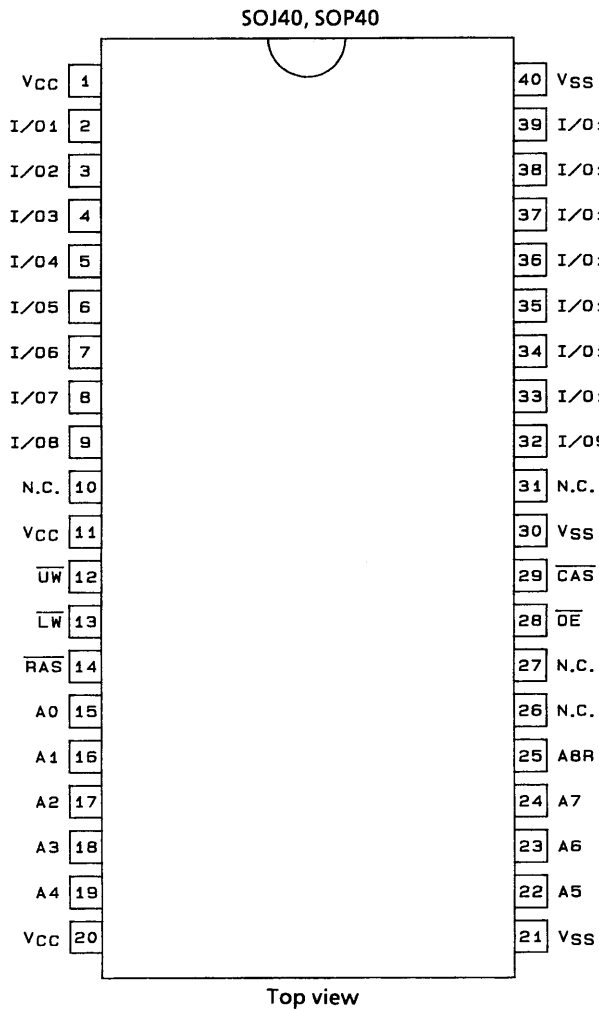


unit: mm

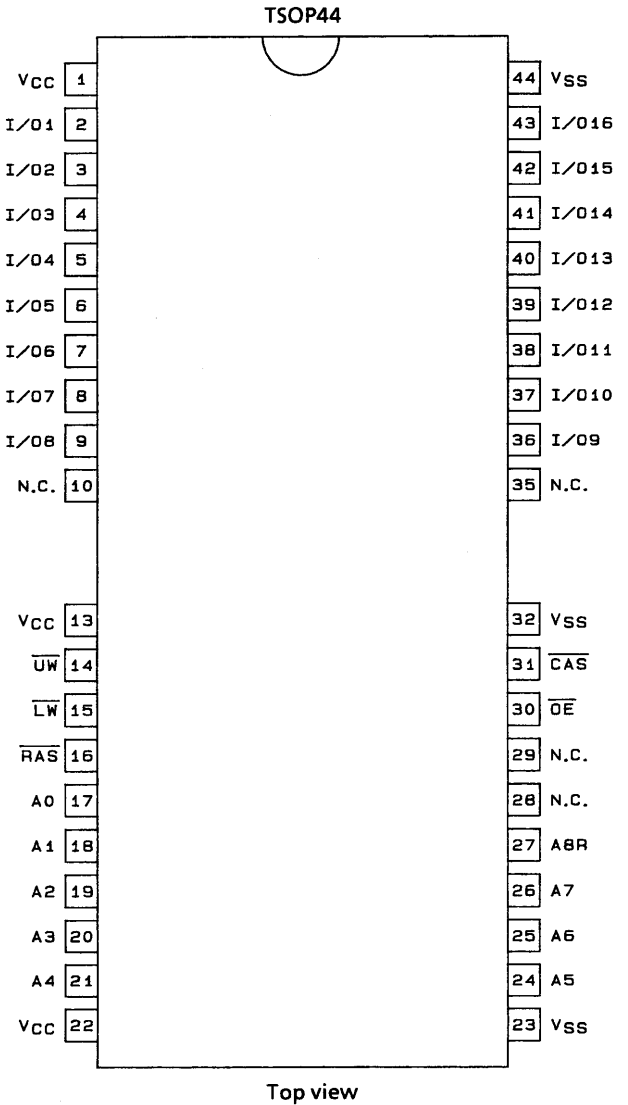
3207-TSOP44



Pin Assignments

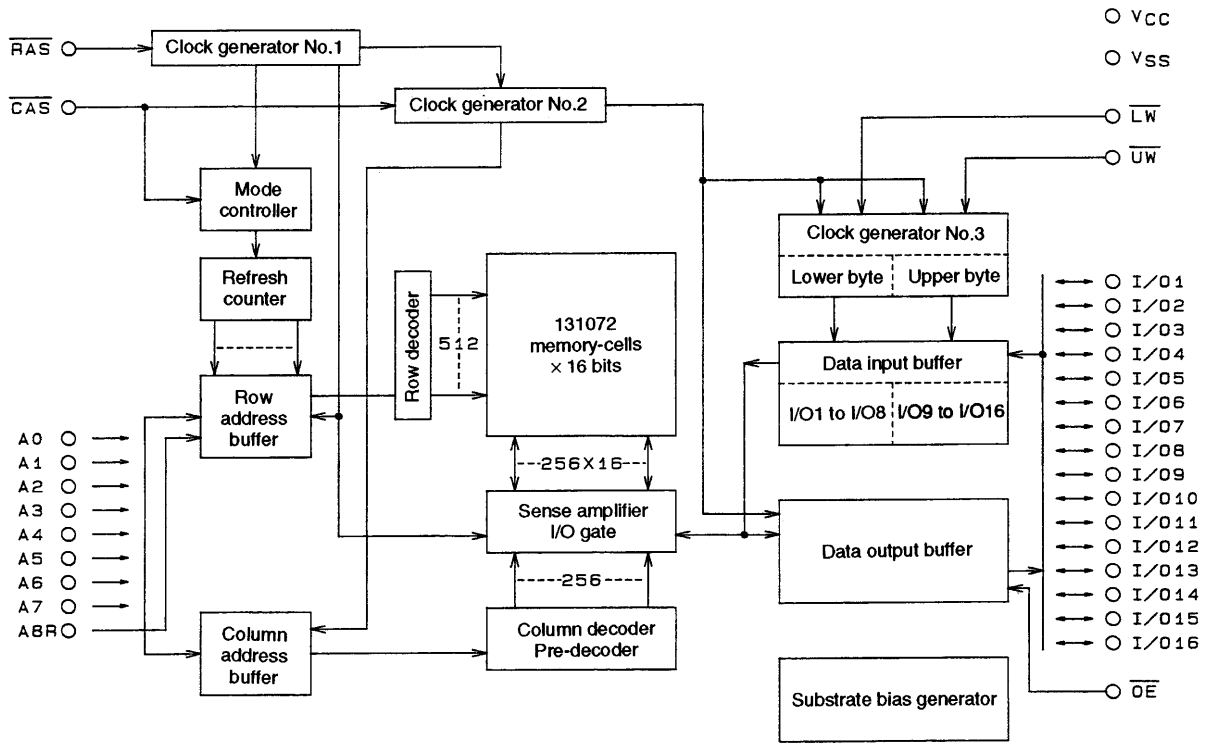


A05195



A05196

Block Diagram



A03904

Specifications

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit	Note
Maximum supply voltage	$V_{CC\ max}$	-1.0 to +7.0	V	1
Input voltage	V_{IN}	-1.0 to +7.0	V	1
Output voltage	V_{OUT}	-1.0 to +7.0	V	1
Allowable power dissipation	LC322271J, M	800	mW	1
	LC322271T	700		
Output short-circuit current	I_{OUT}	50	mA	1
Operating temperature range	T_{opr}	0 to +70	°C	1
Storage temperature range	T_{stg}	-55 to +150	°C	1

Note: 1. Stresses greater than the above listed maximum values may result in damage to the device.

LC322271J, M, T-70/80

DC Recommended Operating Ranges at Ta = 0 to +70°C

Parameter	Symbol	min	typ	max	Unit	Note
Power supply voltage	V _{CC}	4.5	5.0	5.5	V	2
Input high level voltage	V _{IH}	2.4		6.5	V	2
Input low level voltage (A0 to A7, A8R, RAS, CAS, \overline{UW} , \overline{LW} , OE)	V _{IL}	-1.0*		+0.8	V	2
Input low level voltage (I/O1 to I/O16)	V _{IL}	-0.5*		+0.8	V	2

Note: 2. All voltages are referenced to V_{SS}.

*: -2.0 V when pulse width is less than 20 ns.

DC Electrical Characteristics at Ta = 0 to +70°C, V_{CC} = 5 V ± 10%

Parameter	Symbol	Conditions	LC322271J, M, T				Unit	Note
			-70		-80			
			min	max	min	max		
Operating current (Average current during operation)	I _{CC1}	\overline{RAS} , \overline{CAS} , address cycling: t _{RC} = t _{RC} min		125		115	mA	3, 4, 5
Standby current	I _{CC2}	$\overline{RAS} = \overline{CAS} = V_{IH}$		2		2	mA	
\overline{RAS} -only refresh current	I _{CC3}	\overline{RAS} cycling, $\overline{CAS} = V_{IH}$: t _{RC} = t _{RC} min		125		115	mA	3, 5
Fast page mode current	I _{CC4}	$\overline{RAS} = V_{IL}$, \overline{CAS} , address cycling: t _{PC} = t _{PC} min		115		90	mA	3, 4, 5
Standby current	I _{CC5}	$\overline{RAS} = \overline{CAS} = V_{CC} - 0.2 V$		1		1	mA	
\overline{CAS} -before- \overline{RAS} refresh current	I _{CC6}	\overline{RAS} , \overline{CAS} cycling: t _{RC} = t _{RC} min		125		115	mA	3
Input leakage current	I _{IL}	0 V ≤ V _{IN} ≤ 6.5 V, pins other than test pin = 0 V	-10	+10	-10	+10	μA	
Output leakage current	I _{OL}	D _{OUT} disable, 0 V ≤ V _{OUT} ≤ 5.5 V	-10	+10	-10	+10	μA	
Output high level voltage	V _{OH}	I _{OUT} = -2.5 mA	2.4		2.4		V	
Output low level voltage	V _{OL}	I _{OUT} = 2.1 mA		0.4		0.4	V	

Note: 3. All current values are measured at minimum cycle rate. Since current flows immoderately, if cycle time is longer than shown here, current value becomes smaller.

4. I_{CC1} and I_{CC4} are dependent on output loads. Maximum values for I_{CC1} and I_{CC4} represent values with output open.

5. Address change is less than or equal to one time during RAS = V_{IL}. Concerning I_{CC4}, it is less than or equal to one time during 1 cycle (t_{PC}).

AC Electrical Characteristics at Ta = 0 to +70°C, V_{CC} = 5 V ± 10% (Notes 6, 7 and 8)

Parameter	Symbol	-70		-80		Unit	Note
		min	max	min	max		
Random read, write cycle time	t _{RC}	130		150		ns	
Read-write/read-modify-write cycle time	t _{RWC}	190		200		ns	
Fast page mode cycle time	t _{PC}	45		55		ns	
Fast page mode read-write/read-modify-write cycle time	t _{PRWC}	95		100		ns	
\overline{RAS} access time	t _{RAC}		70		80	ns	9, 14, 15
\overline{CAS} access time	t _{CAC}		20		30	ns	9, 14
Column address access time	t _{AA}		35		45	ns	9, 15
\overline{CAS} precharge access time	t _{CPA}		40		50	ns	9
Output low-impedance time from \overline{CAS} low	t _{CLZ}	0		0		ns	9
Output buffer turn-off delay time	t _{OFF}	0	20	0	20	ns	10
Rise, fall time	t _T	3	50	3	50	ns	
\overline{RAS} precharge time	t _{RP}	50		60		ns	
\overline{RAS} pulse width	t _{RAS}	70	10000	80	10000	ns	
\overline{RAS} pulse width for fast page mode cycle only	t _{RASP}	70	100000	80	100000	ns	

Continued on next page.

LC322271J, M, T-70/80

Continued from preceding page.

Parameter	Symbol	-70		-80		Unit	Note
		min	max	min	max		
$\overline{\text{RAS}}$ hold time	t_{RSH}	20		30		ns	
$\overline{\text{CAS}}$ hold time	t_{CSH}	70		80		ns	
$\overline{\text{CAS}}$ pulse width	t_{CAS}	20	10000	30	10000	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ delay time	t_{RCD}	25	50	25	50	ns	14
$\overline{\text{RAS}}$ to column address delay time	t_{RAD}	17	35	17	35	ns	15
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ precharge time	t_{CRP}	10		10		ns	
$\overline{\text{CAS}}$ precharge time	t_{CP}	10		10		ns	
Row address setup time	t_{ASR}	0		0		ns	
Row address hold time	t_{RAH}	12		12		ns	
Column address setup time	t_{ASC}	0		0		ns	
Column address hold time	t_{CAH}	15		20		ns	
Column address hold time referenced to $\overline{\text{RAS}}$	t_{AR}	50		60		ns	
Column address to $\overline{\text{RAS}}$ lead time	t_{RAL}	40		45		ns	
Read command setup time	t_{RCS}	0		0		ns	
Read command hold time referenced to $\overline{\text{CAS}}$	t_{RCH}	0		0		ns	11
Read command hold time referenced to $\overline{\text{RAS}}$	t_{RRH}	0		0		ns	11
Write command hold time	t_{WCH}	15		15		ns	
Write command hold time referenced to $\overline{\text{RAS}}$	t_{WCR}	50		60		ns	
Write command pulse width	t_{WP}	15		15		ns	
Write command to $\overline{\text{RAS}}$ lead time	t_{RWL}	25		25		ns	
Write command to $\overline{\text{CAS}}$ lead time	t_{CWL}	20		20		ns	
Data input setup time	t_{DS}	0		0		ns	12
Data input hold time	t_{DH}	15		20		ns	12
Data input hold time referenced to $\overline{\text{RAS}}$	t_{DHR}	50		60		ns	
Refresh time	t_{REF}		8		8	ms	
Write command setup time	t_{WCS}	0		0		ns	13
$\overline{\text{CAS}}$ to $\overline{\text{UW}}$, $\overline{\text{LW}}$ delay time	t_{CWD}	50		50		ns	13
$\overline{\text{RAS}}$ to $\overline{\text{UW}}$, $\overline{\text{LW}}$ delay time	t_{RWD}	100		100		ns	13
Column address to $\overline{\text{UW}}$, $\overline{\text{LW}}$ delay time	t_{AWD}	65		65		ns	13
$\overline{\text{CAS}}$ precharge $\overline{\text{UW}}$, $\overline{\text{LW}}$ delay time for fast page mode cycle only	t_{CPWD}	70		70		ns	13
$\overline{\text{CAS}}$ setup time for $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$	t_{CSR}	10		10		ns	
$\overline{\text{CAS}}$ hold time for $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$	t_{CHR}	15		15		ns	
$\overline{\text{RAS}}$ precharge $\overline{\text{CAS}}$ active time	t_{RPC}	10		10		ns	
$\overline{\text{CAS}}$ precharge time for $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ counter test	t_{CPT}	40		40		ns	
$\overline{\text{RAS}}$ hold time referenced to $\overline{\text{OE}}$	t_{ROH}	15		15		ns	
$\overline{\text{OE}}$ access time	t_{OEA}		20		25	ns	9
$\overline{\text{OE}}$ delay time	t_{OED}	15		15		ns	
$\overline{\text{OE}}$ output buffer turn-off delay time	t_{OEZ}	0		0	15	ns	10
$\overline{\text{OE}}$ command hold time	t_{OEH}	20		20		ns	
Data input to $\overline{\text{CAS}}$ delay time	t_{DZC}	0		0		ns	16
Data input to $\overline{\text{OE}}$ delay time	t_{DZO}	0		0		ns	16
Masked write setup time	t_{MCS}	0		0		ns	
Masked write hold time referenced to $\overline{\text{RAS}}$	t_{MRH}	0		0		ns	
Masked write hold time referenced to $\overline{\text{CAS}}$	t_{MCH}	0		0		ns	

LC322271J, M, T-70/80

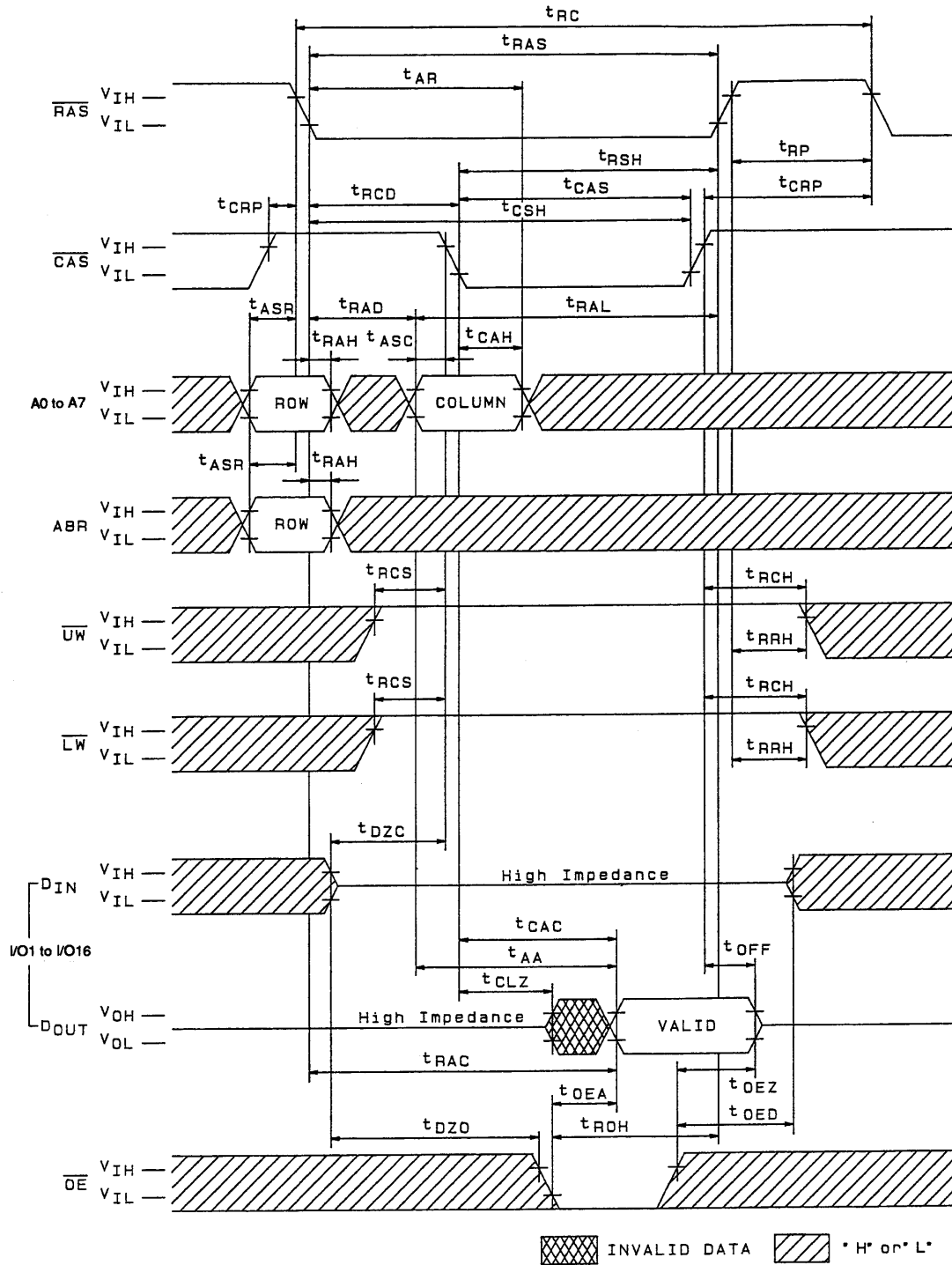
Input/Output Capacitance at $T_a = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $V_{CC} = 5\text{ V} \pm 10\%$

Parameter	Symbol	min	max	Unit	Note
Input capacitance (A0 to A7, A8R, $\overline{\text{RAS}}$, $\overline{\text{CAS}}$, $\overline{\text{UW}}$, $\overline{\text{LW}}$, $\overline{\text{OE}}$)	C_{IN}		7	pF	
Input/Output capacitance (I/O1 to I/O16)	$C_{\text{I/O}}$		7	pF	

- Note:
6. An initial pause of 200 μs is required after power-up followed by eight $\overline{\text{RAS}}$ -only refresh cycles before proper device operation is achieved. In case of using refresh counter, a minimum of eight $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ refresh cycles instead of eight $\overline{\text{RAS}}$ -only refresh cycles are required.
 7. Measured at $t_T = 5\text{ ns}$.
 8. When measuring input signal timing, V_{IH} (min) and V_{IL} (max) are used for reference points. In addition, rise and fall time are defined between V_{IH} and V_{IL} .
 9. Measured using an equivalent of 50 pF and one standard TTL loads.
 10. t_{OFF} (max) and t_{OEZ} (max) are defined as the time until output voltage can no longer be measured when output switches to a high impedance condition.
 11. Operation is guaranteed if either t_{RRH} or t_{RCH} is satisfied.
 12. These parameters are measured from the falling edge of $\overline{\text{CAS}}$ for an early-write cycle, and from the falling edge of $\overline{\text{UW}}$ and $\overline{\text{LW}}$ for a read-write/read-modify-write cycle.
 13. t_{WCS} , t_{CWD} , t_{RWD} , t_{AWD} and t_{CPWD} are not restrictive operating parameters for memory in that they specify the operating mode. If $t_{\text{WCS}} \geq t_{\text{WCS}}(\text{min})$, the cycle switches to an early-write cycle and output pins switch to high impedance throughout the cycle. If $t_{\text{CWD}} \geq t_{\text{CWD}}(\text{min})$, $t_{\text{RWD}} \geq t_{\text{RWD}}(\text{min})$, $t_{\text{AWD}} \geq t_{\text{AWD}}(\text{min})$ and $t_{\text{CPWD}} \geq t_{\text{CPWD}}(\text{min})$ for fast page mode cycle only, the cycle switches to a read-write/read-modify-write cycle and data output equal information in the selected cells. If neither of the above timings are satisfied, output pins are in an undefined state.
 14. $t_{\text{RCD}}(\text{max})$ is not a restrictive operating parameter but instead represents the point at which the access time $t_{\text{RAC}}(\text{max})$ is guaranteed. If $t_{\text{RCD}} \geq t_{\text{RCD}}(\text{max})$, access time is determined according to t_{CAC} .
 15. $t_{\text{RAD}}(\text{max})$ is not a restrictive operating parameter but instead represents the point at which the access time $t_{\text{RAC}}(\text{max})$ is guaranteed. If $t_{\text{RAD}} \geq t_{\text{RAD}}(\text{max})$, access time is determined according to t_{AA} .
 16. Operation is guaranteed if either t_{DZC} or t_{DZO} is satisfied.

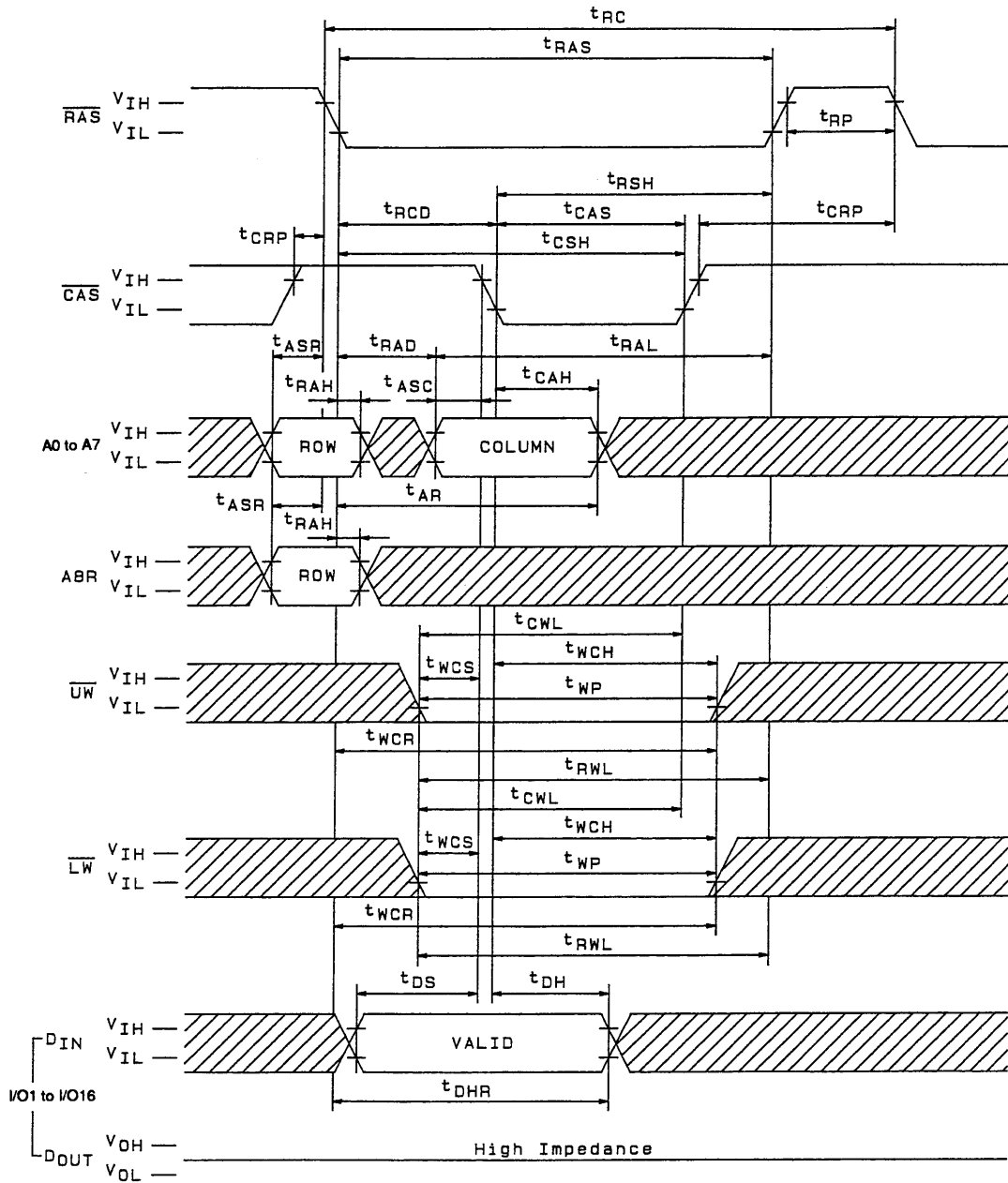
Timing Chart

Read Cycle



A02907

Early Write Cycle

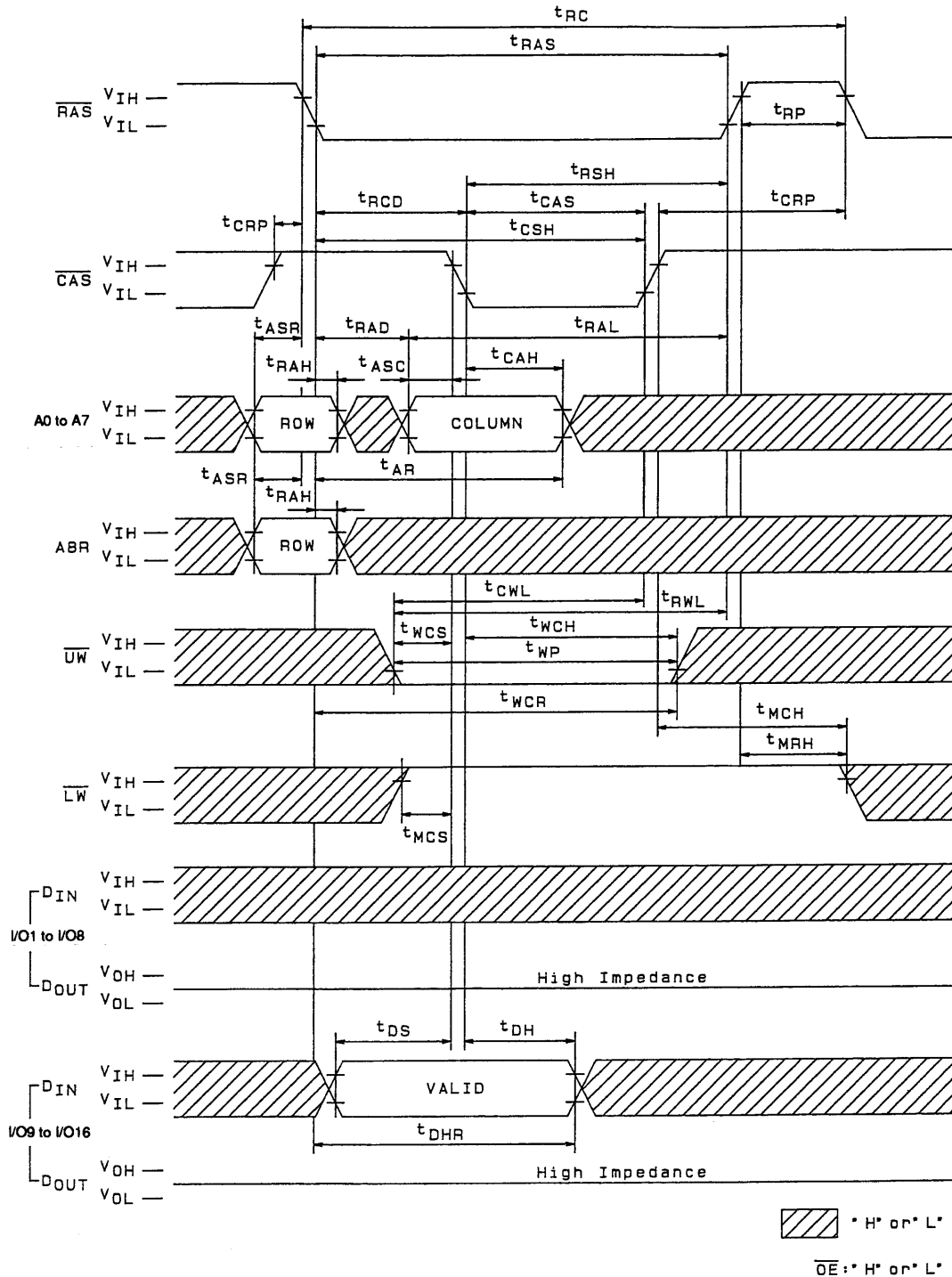


* H* or L*

\overline{OE} : * H* or L*

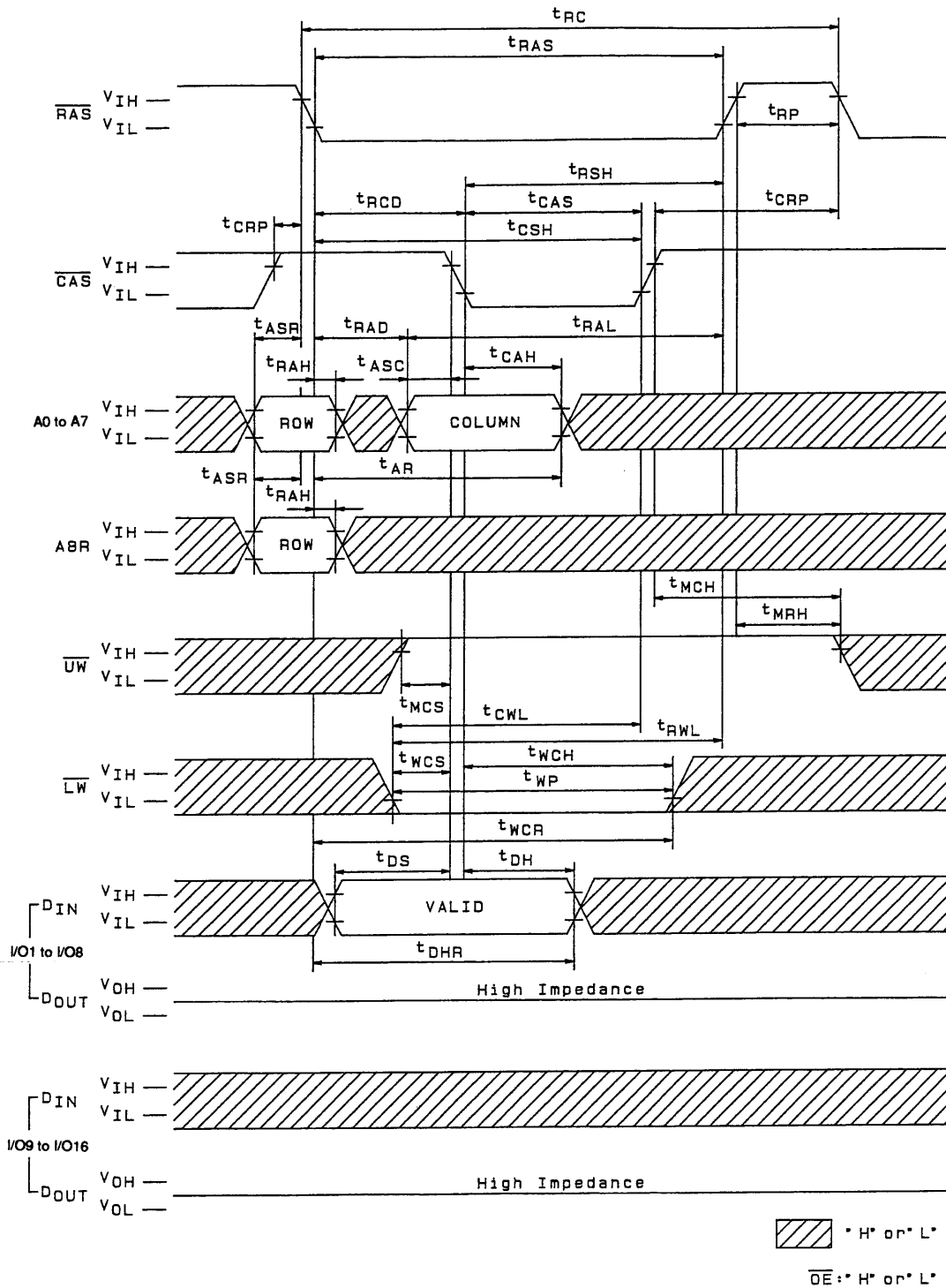
A02808

Upper Byte Early Write Cycle



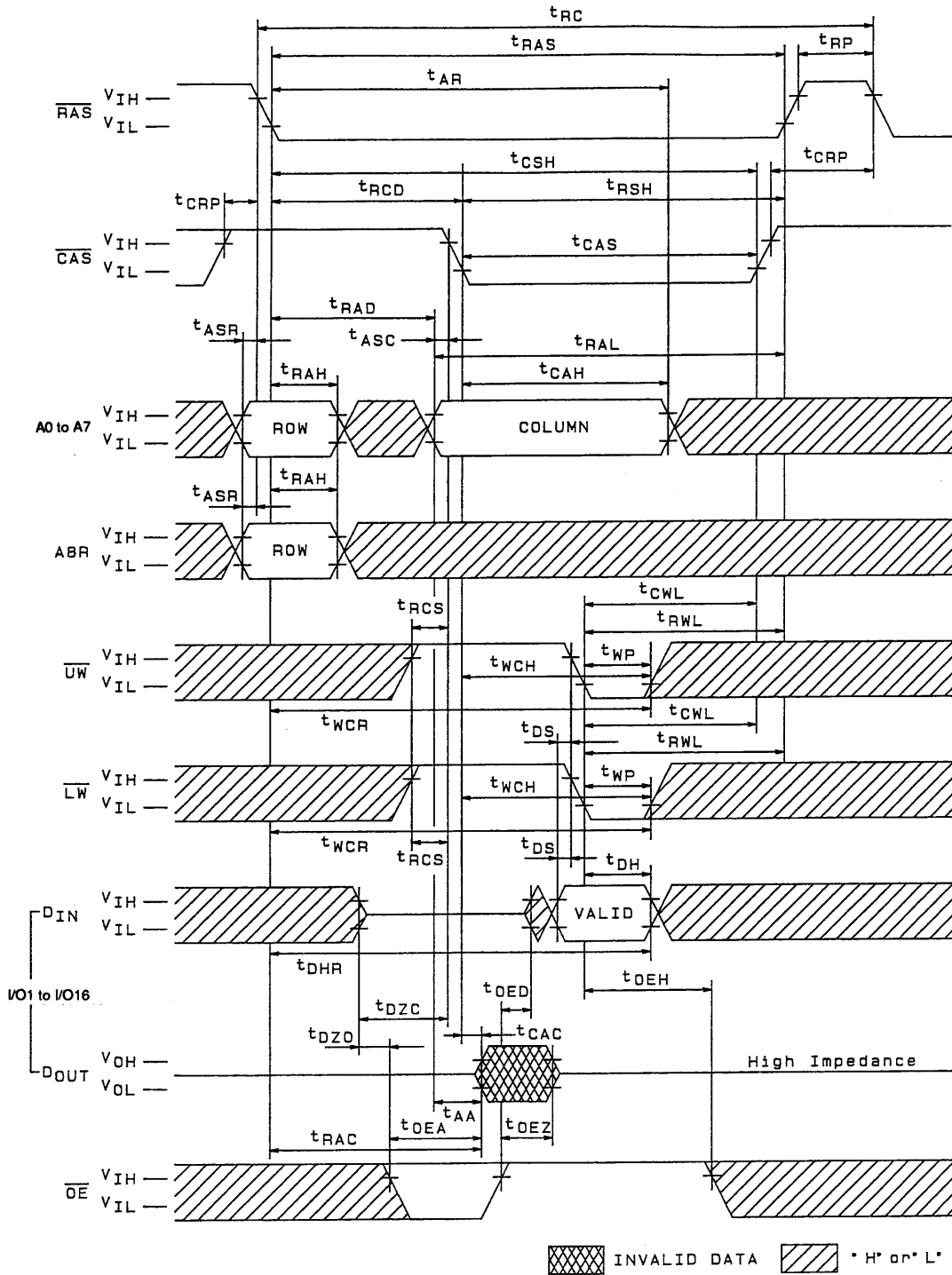
A02909

Lower Byte Early Write Cycle



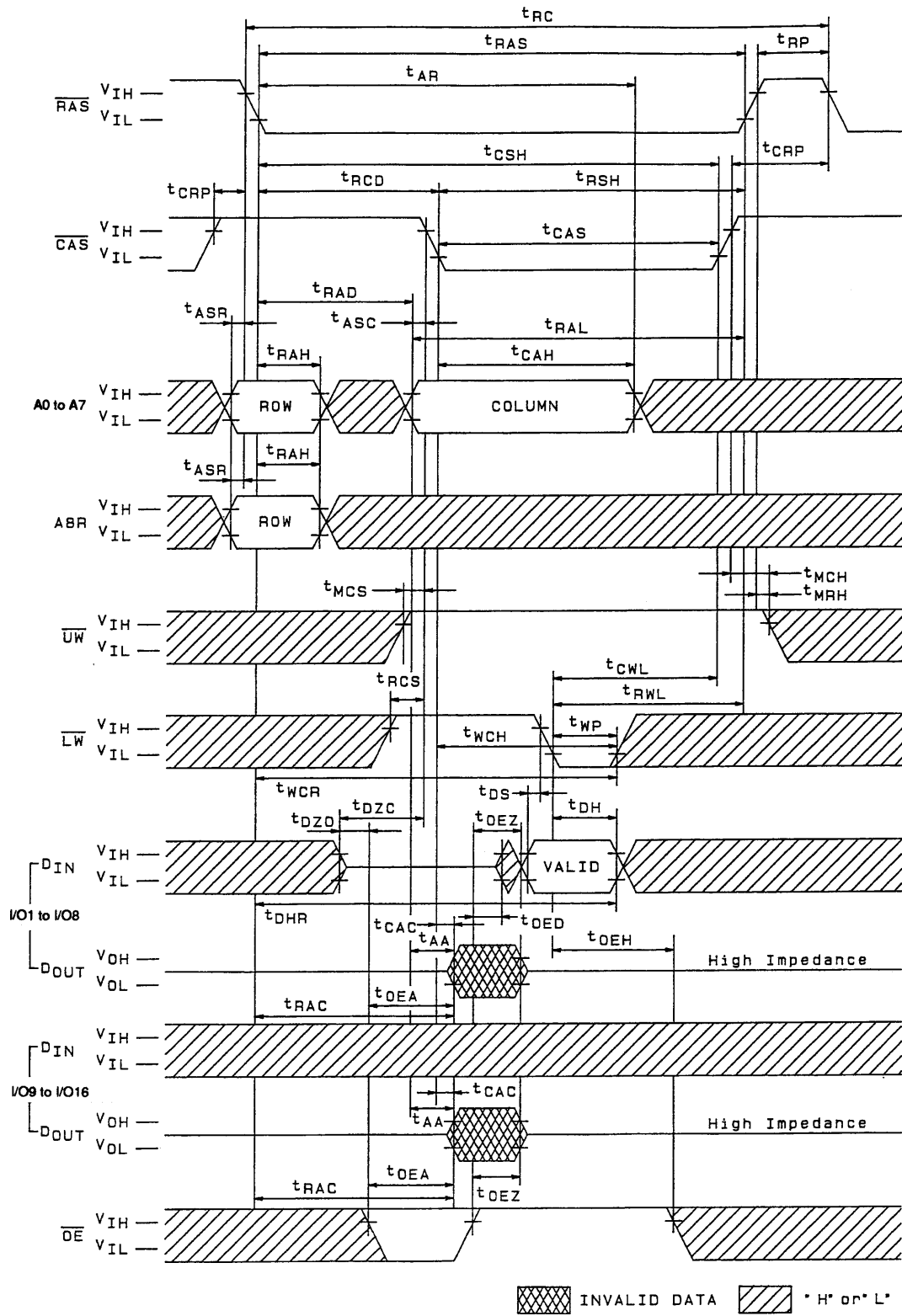
A02910

Write Cycle (\overline{OE} Control)



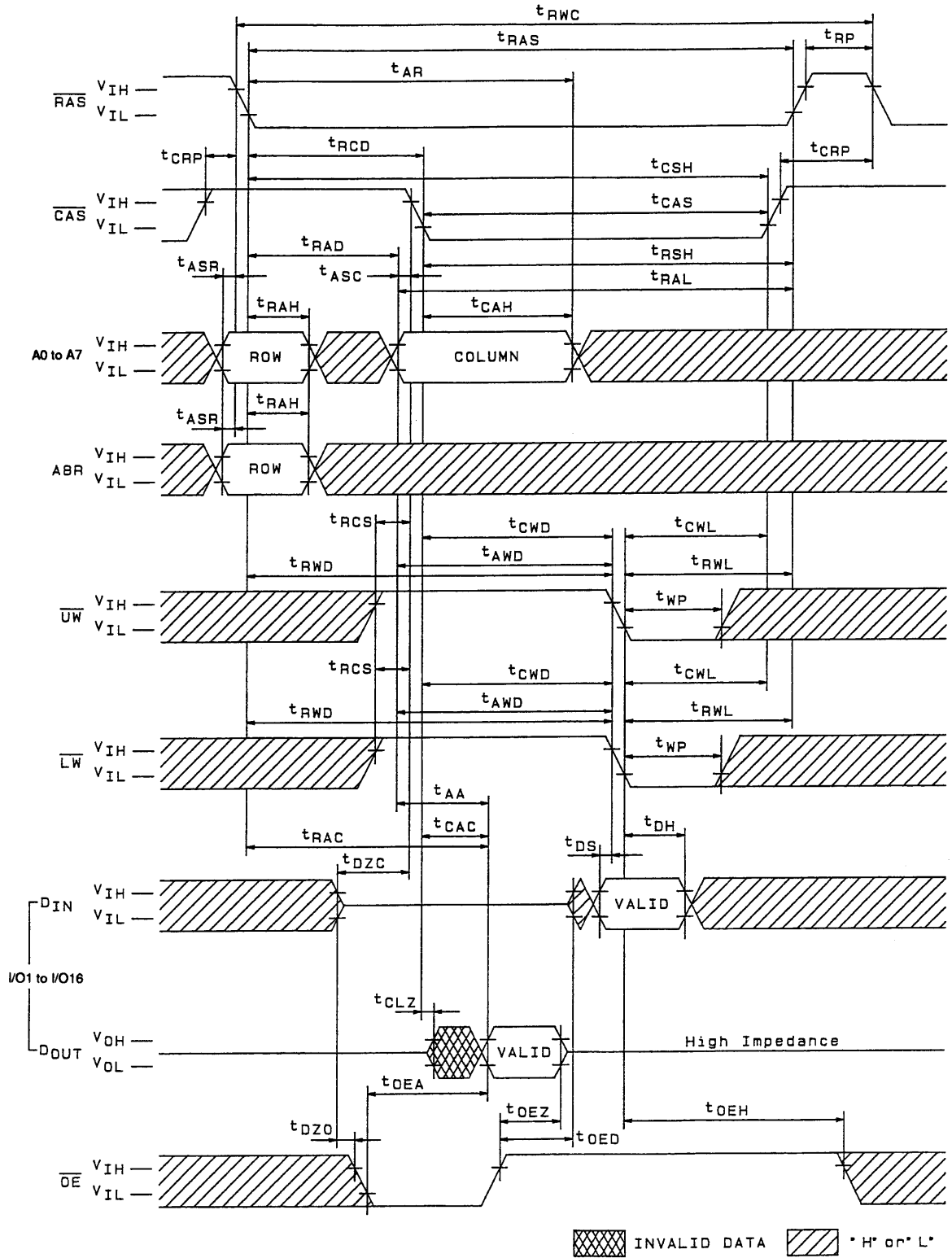
A02911

Lower Byte Write Cycle (\overline{OE} Control)

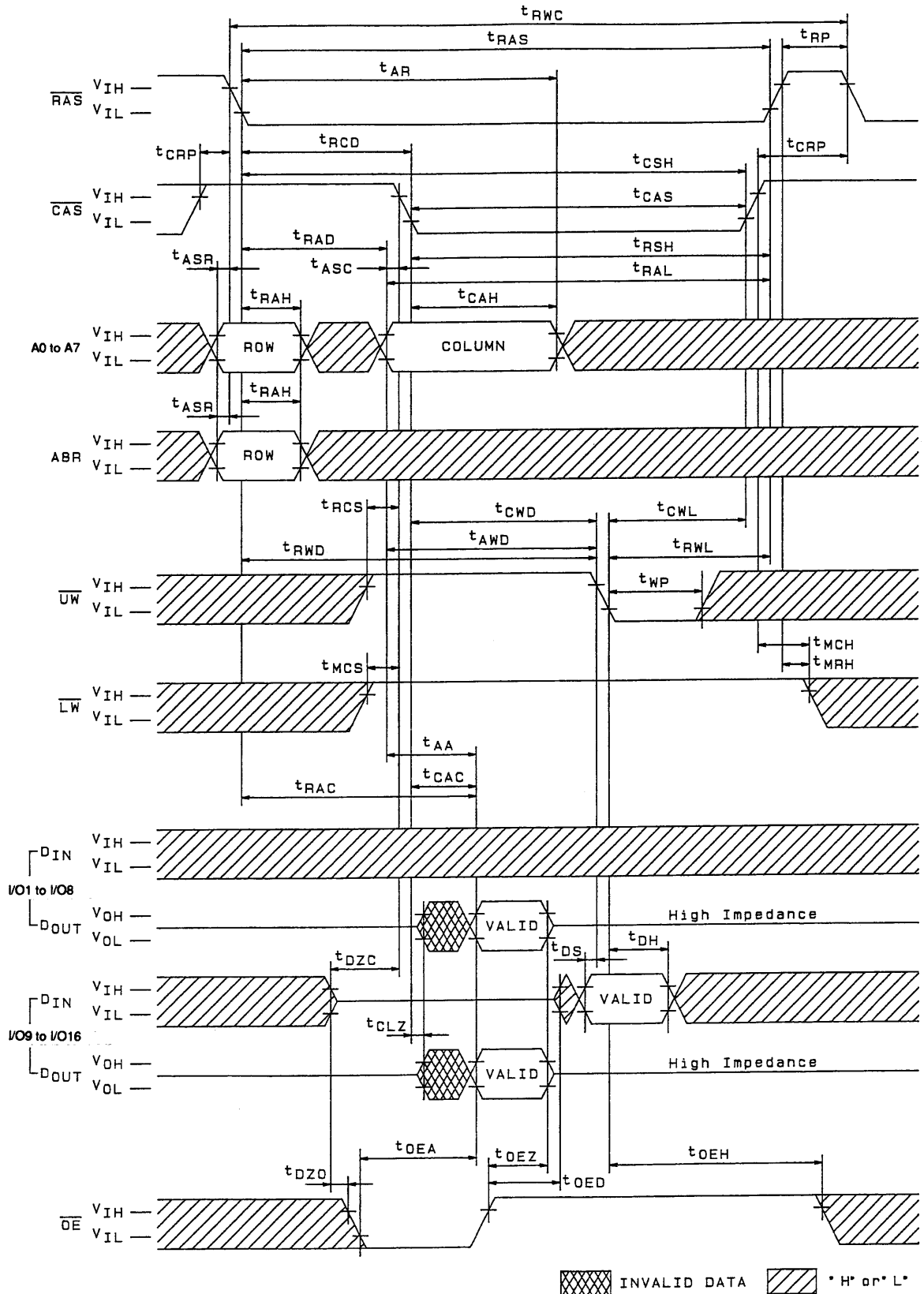


A02913

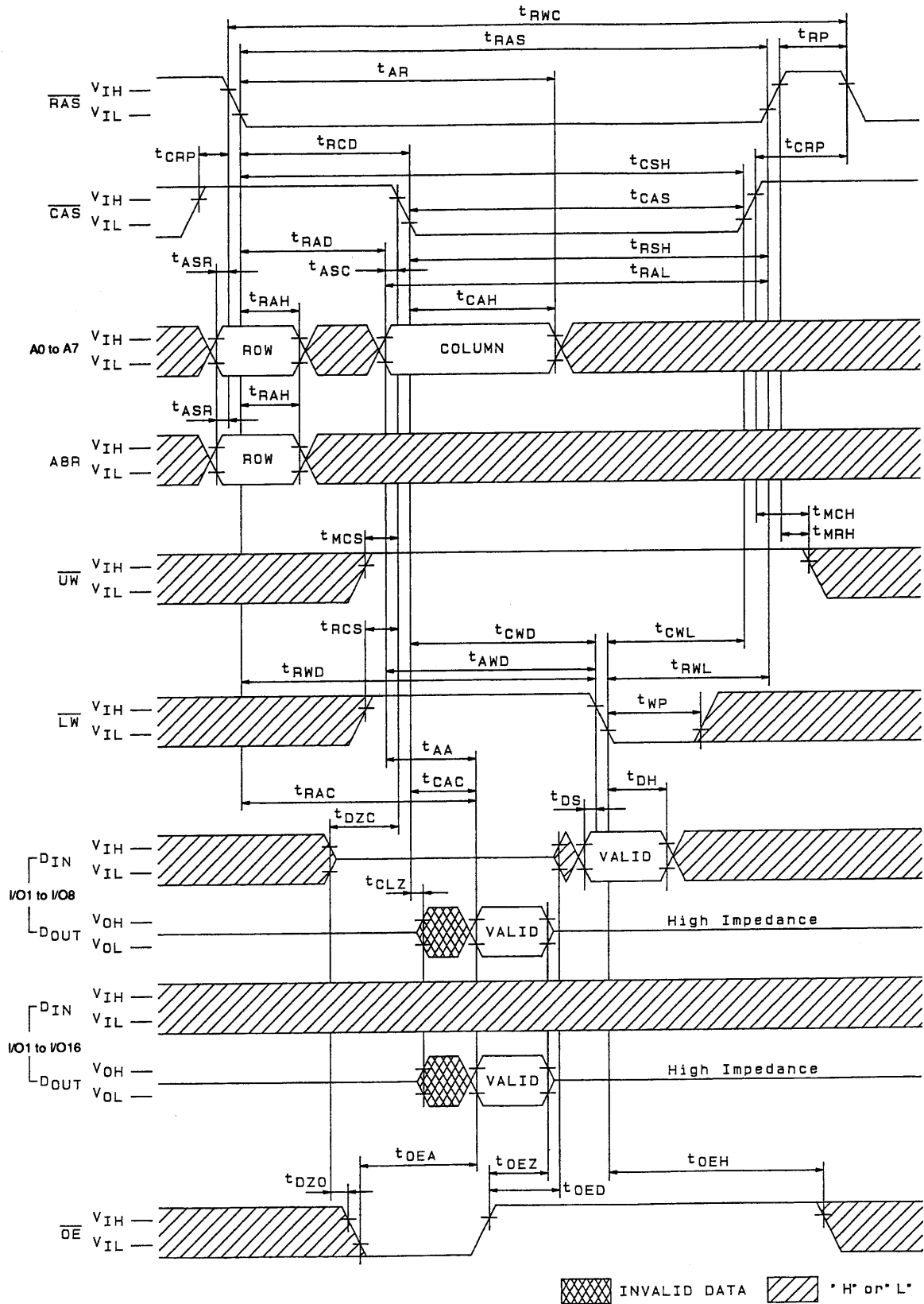
Read-Modify-Write Cycle



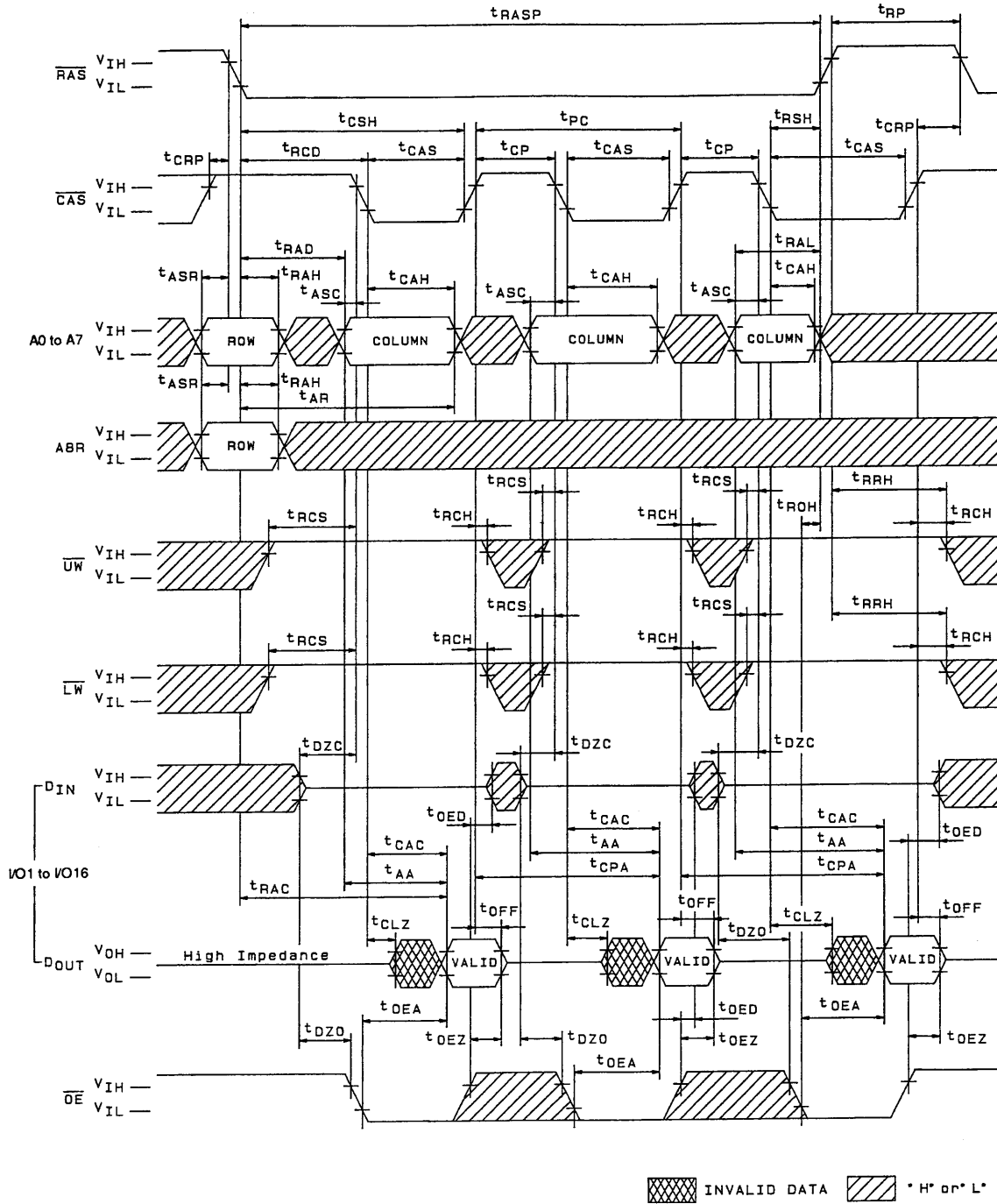
Read-Modify Upper Byte Write Cycle



Read-Modify Lower Byte Write Cycle

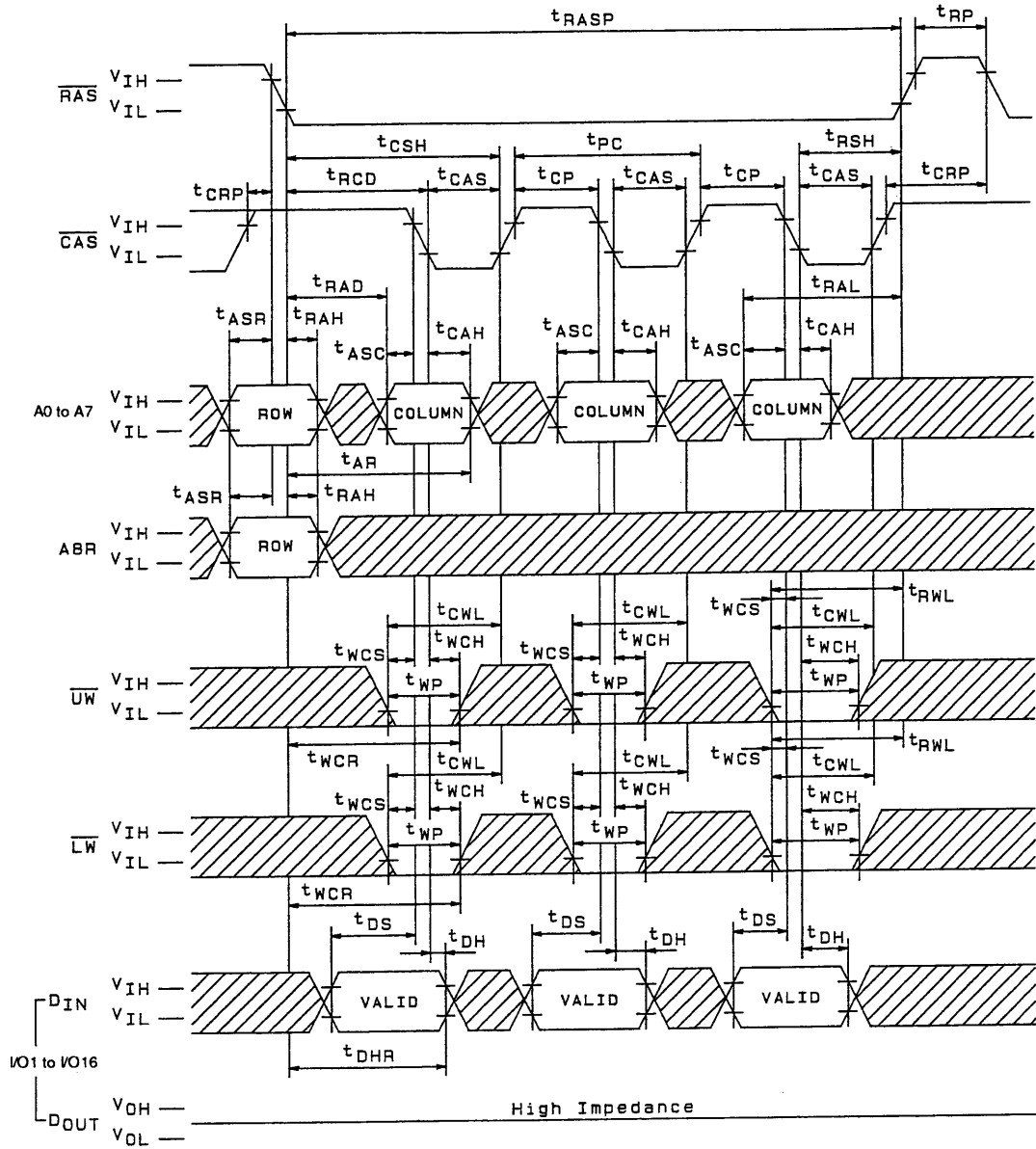


Fast Page Mode Read Cycle



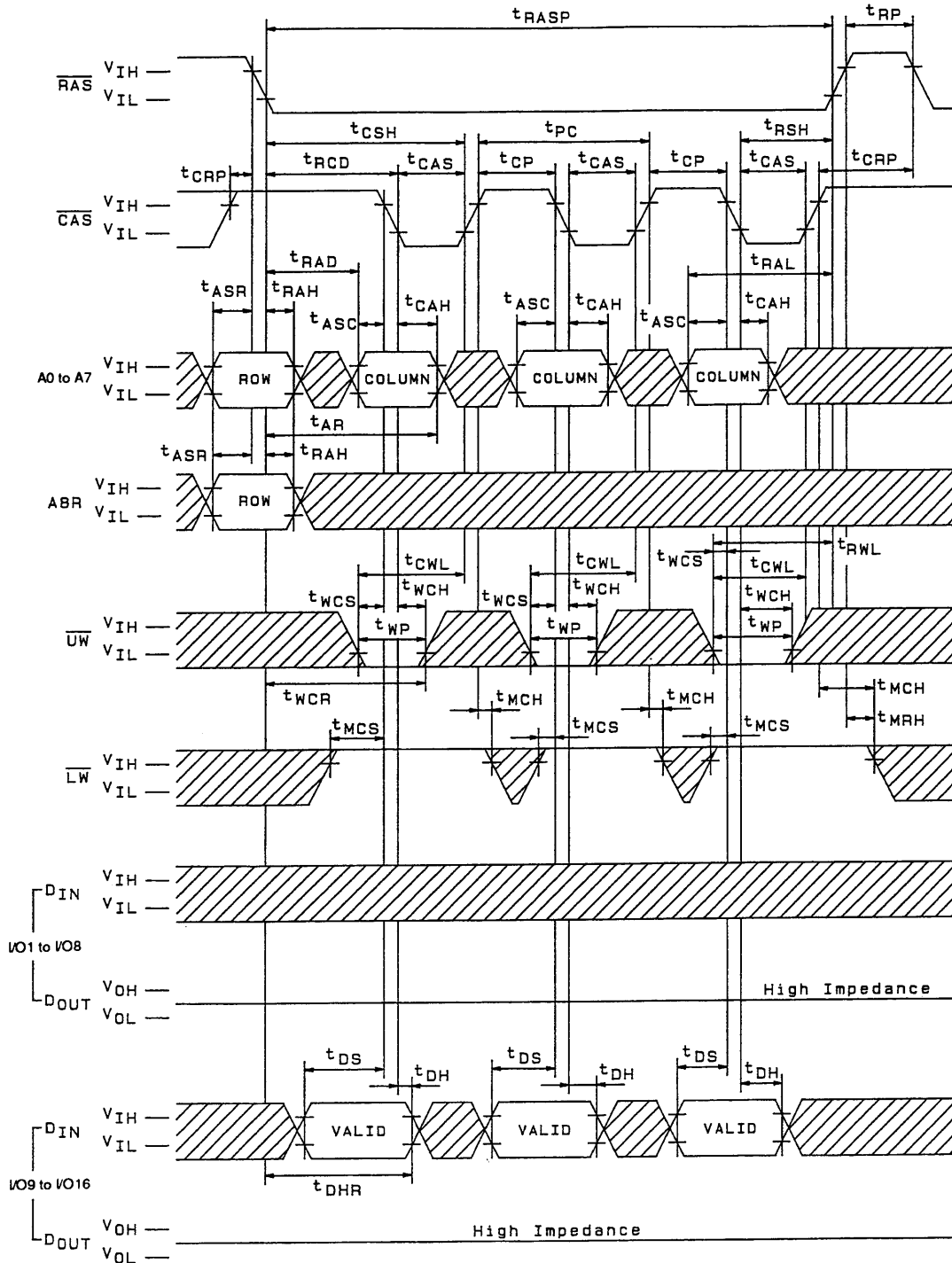
A02917

Fast Page Mode Early Write Cycle



A02918

Fast Page Mode Upper Byte Early Write Cycle

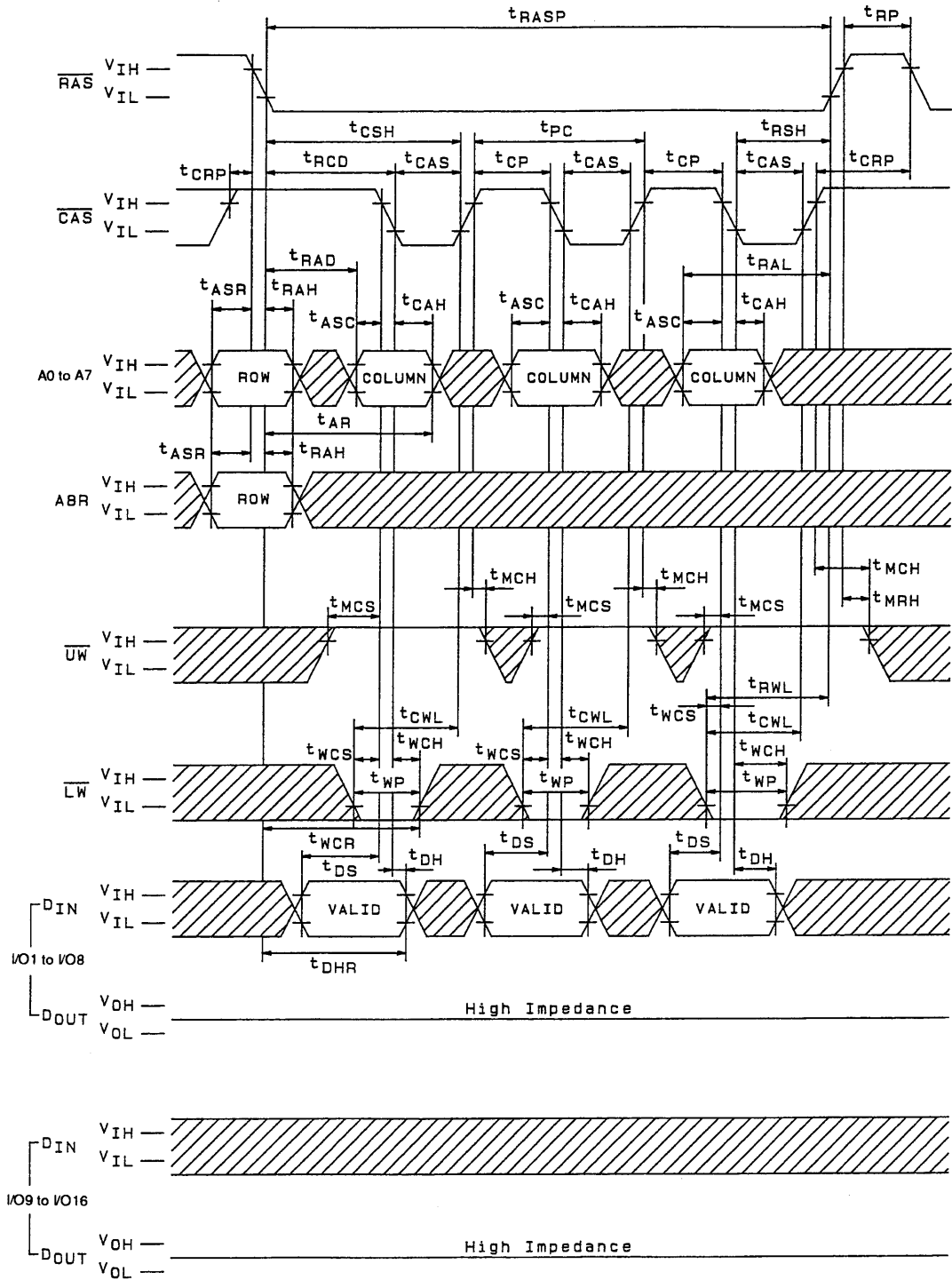


▨ * H* or * L*

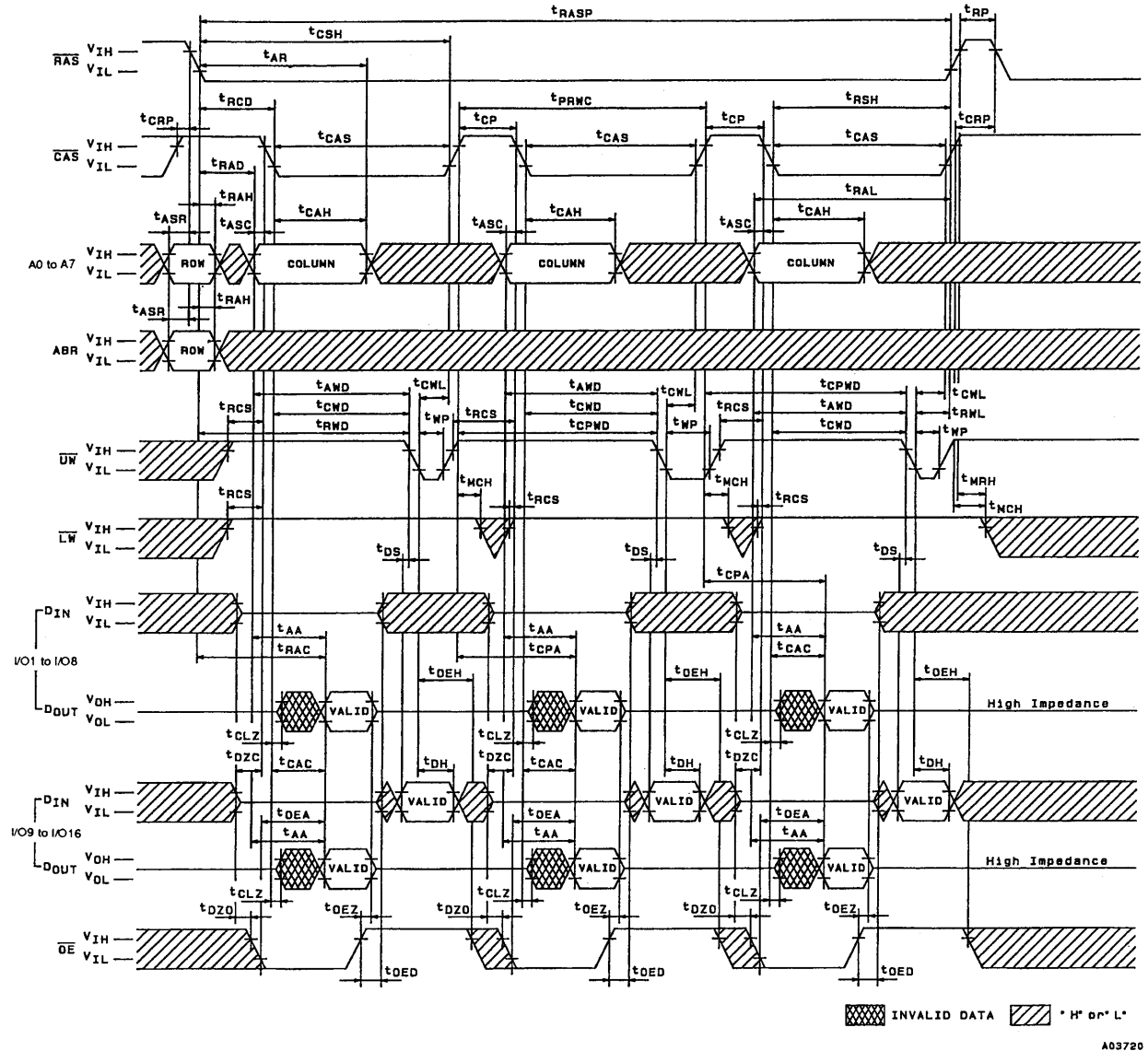
\overline{OE} : * H* or * L*

A02919

Fast Page Mode Lower Byte Early Write Cycle

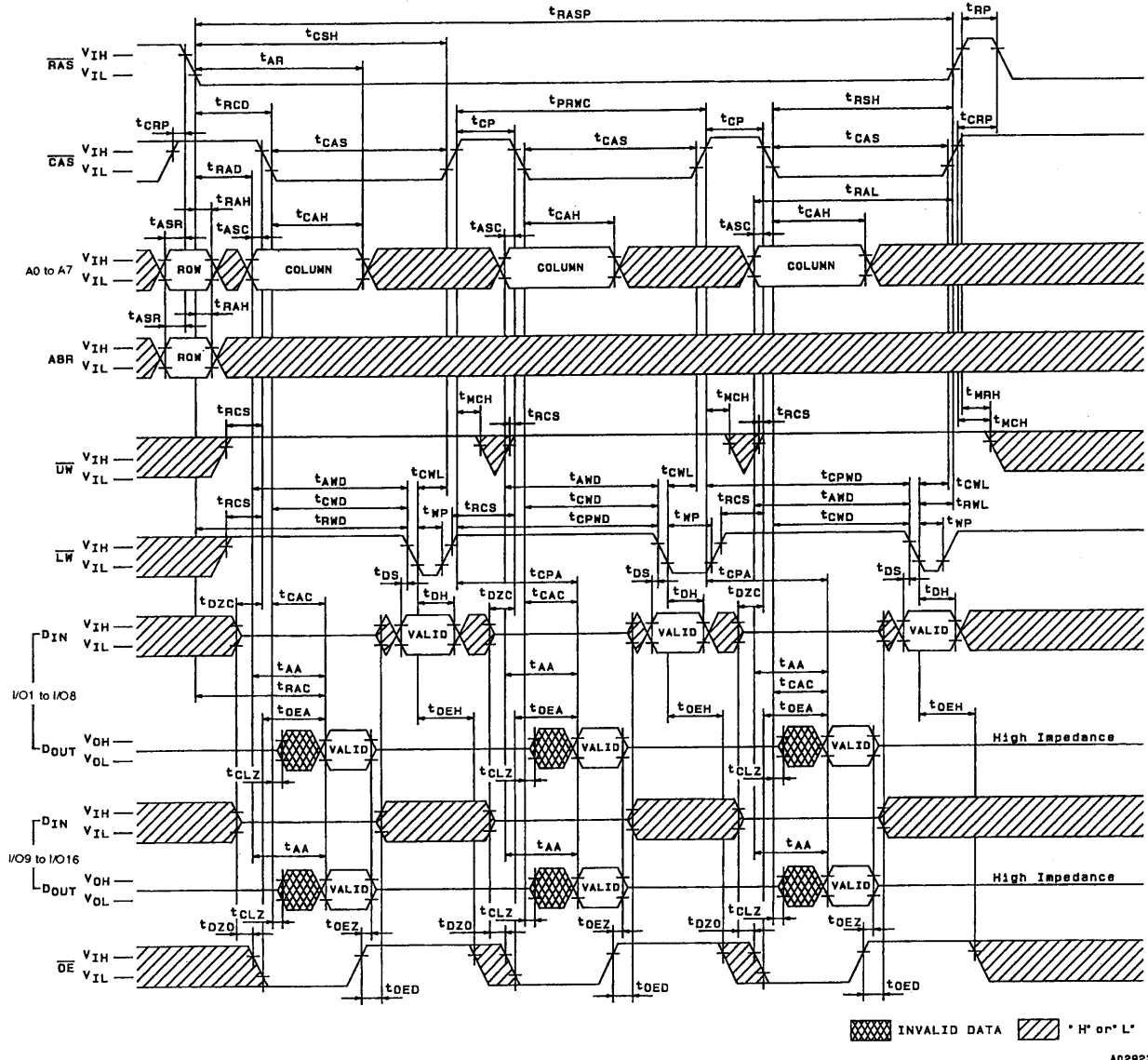


Fast Page Mode Read-Modify Upper Byte Write Cycle



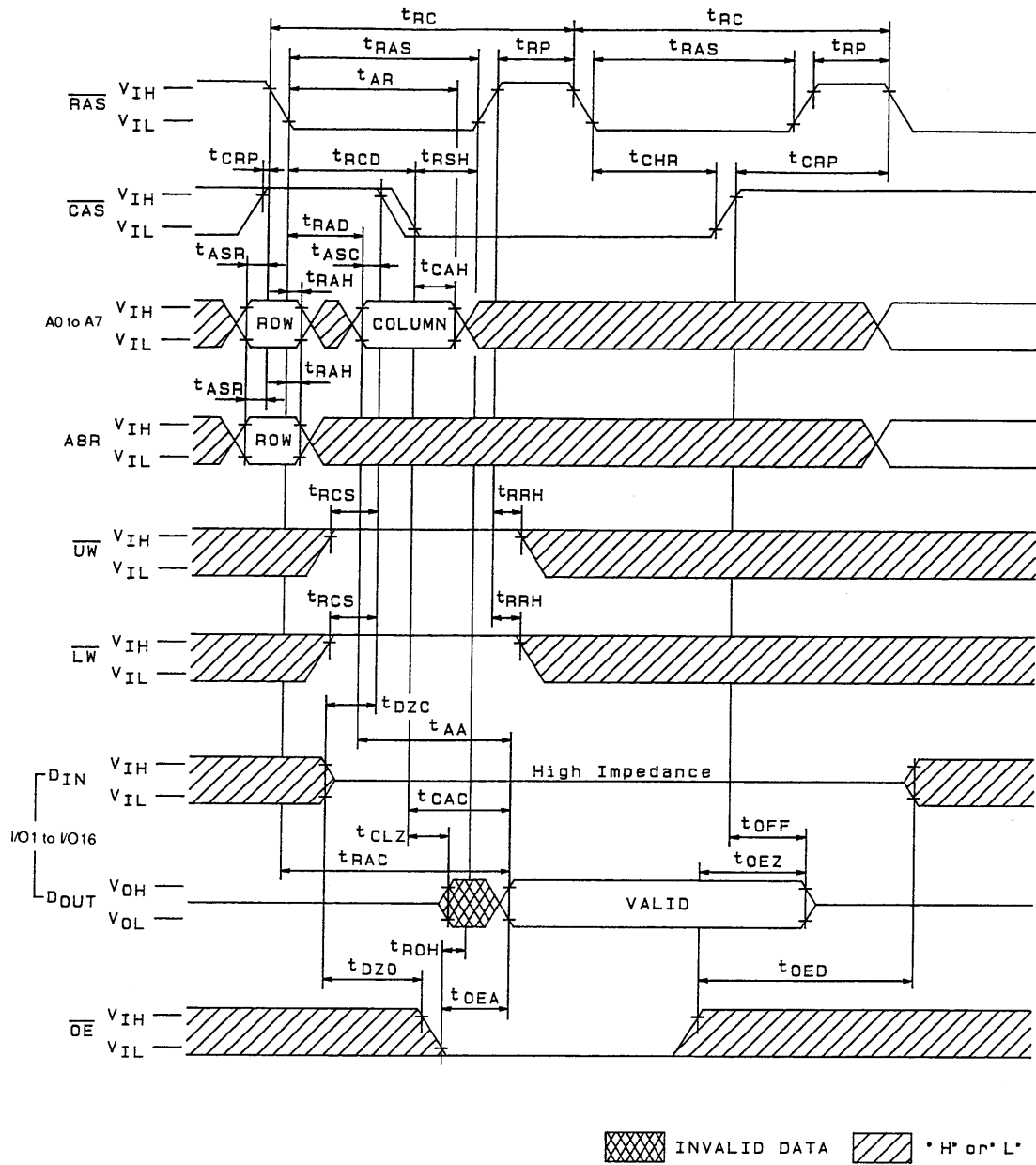
A03720

Fast Page Mode Read-Modify Lower Byte Write Cycle



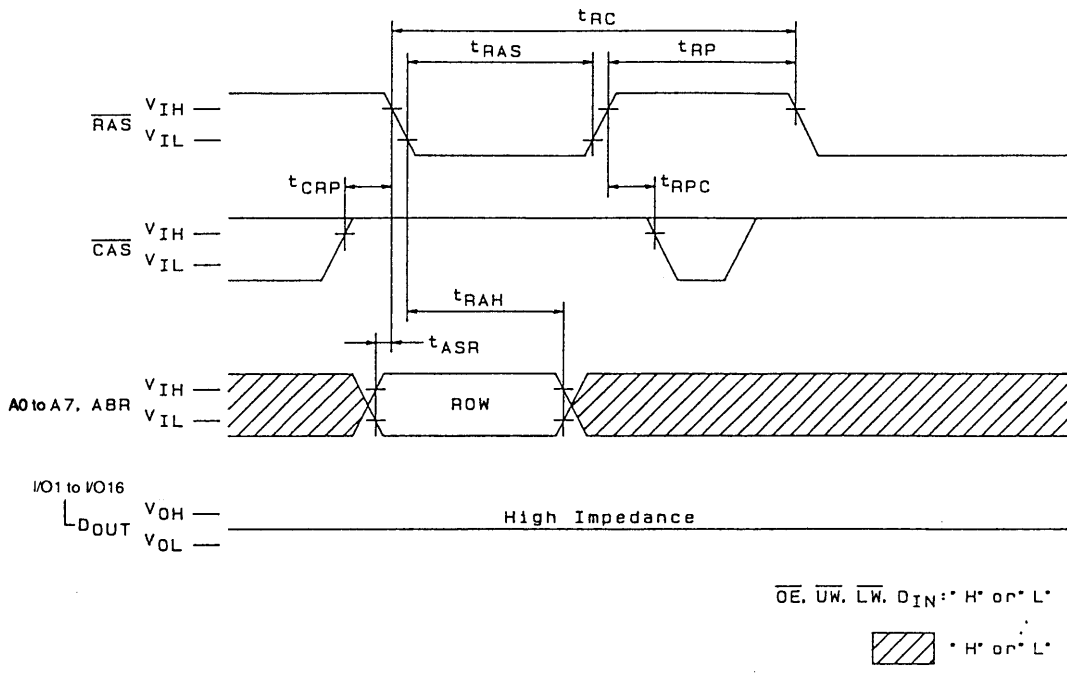
A02923

Hidden Refresh Cycle



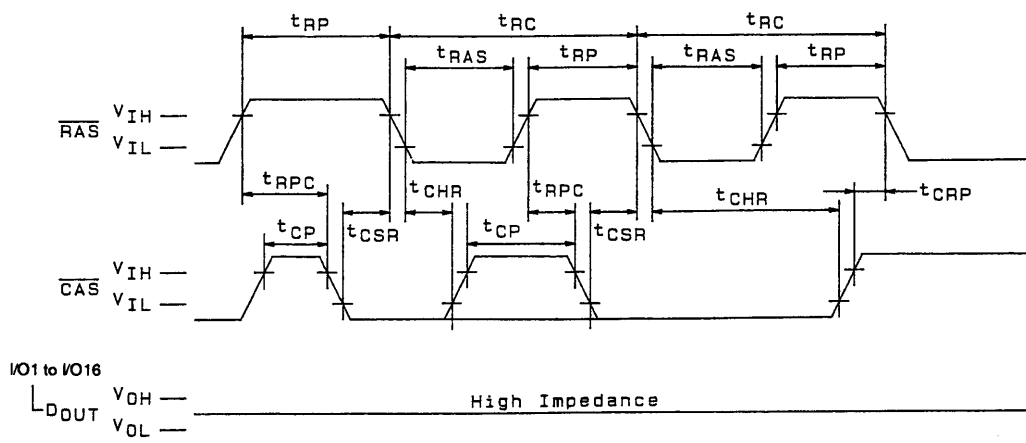
A02924

RAS-Only Refresh Cycle



A02925

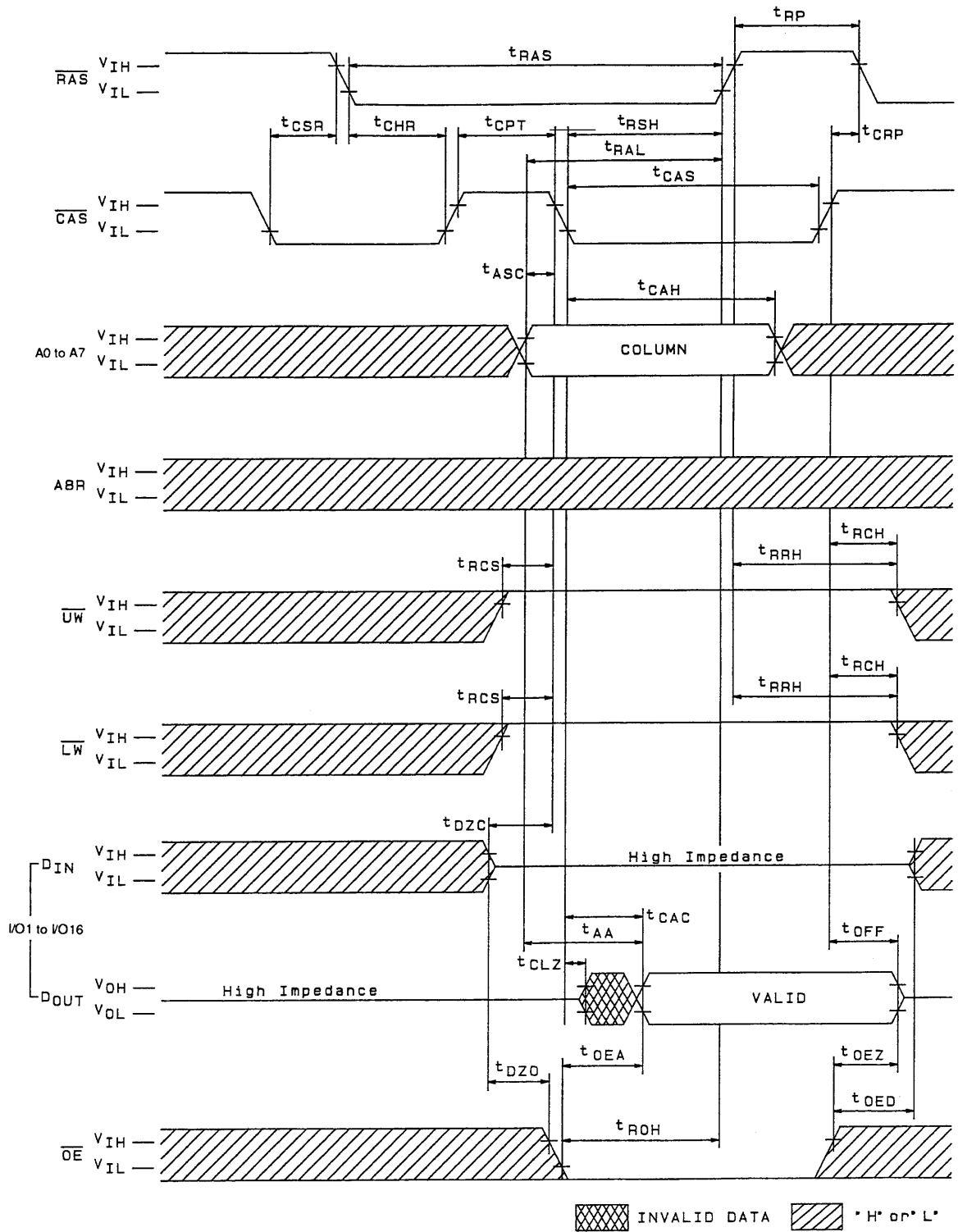
CAS-Before-RAS Refresh Cycle



A0 to A7, ABR, $\overline{UW}, \overline{LW}, \overline{OE}, \overline{DIN}$: "H" or "L"

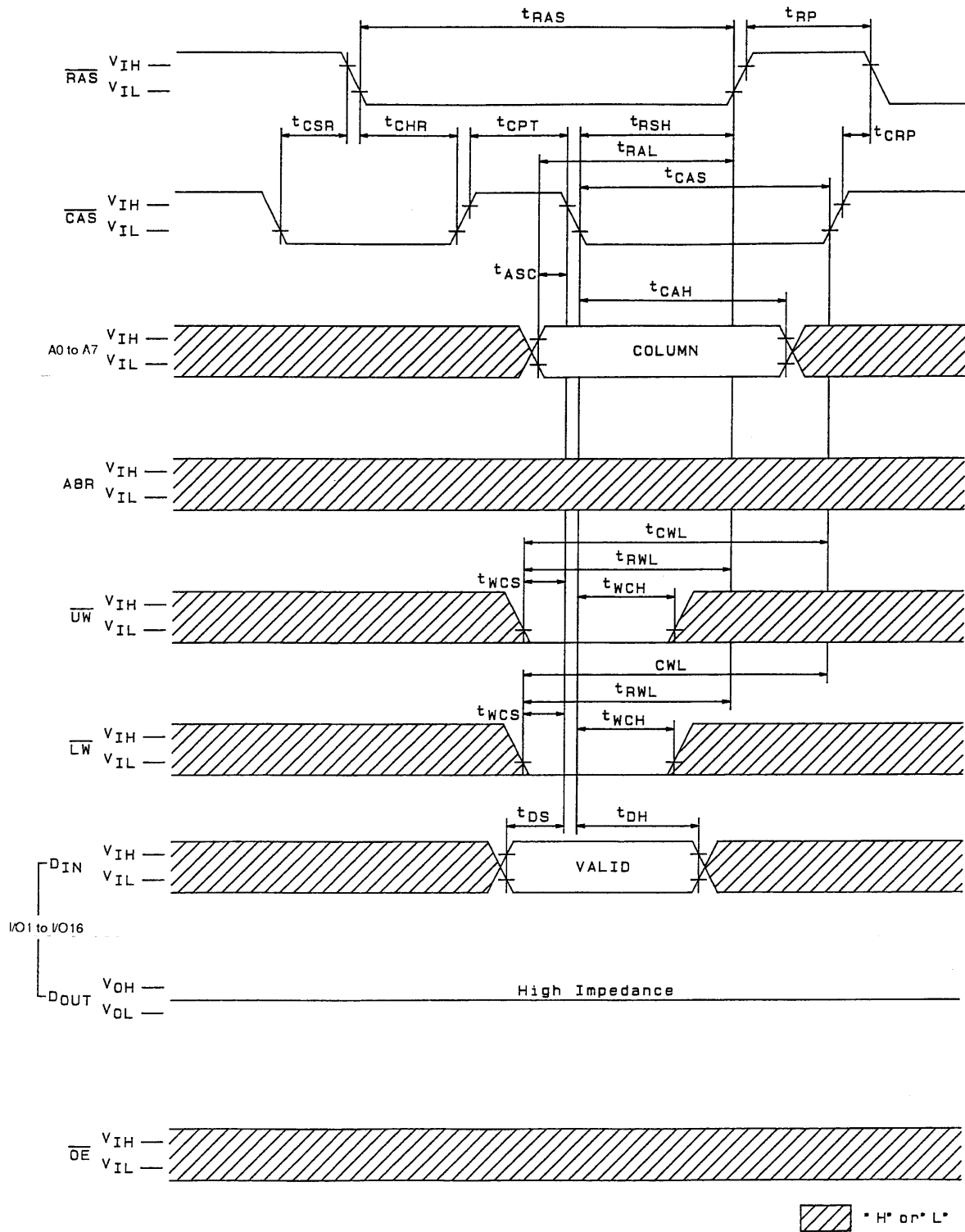
A02926

CAS-Before-RAS Refresh Counter Test Cycle (Read)



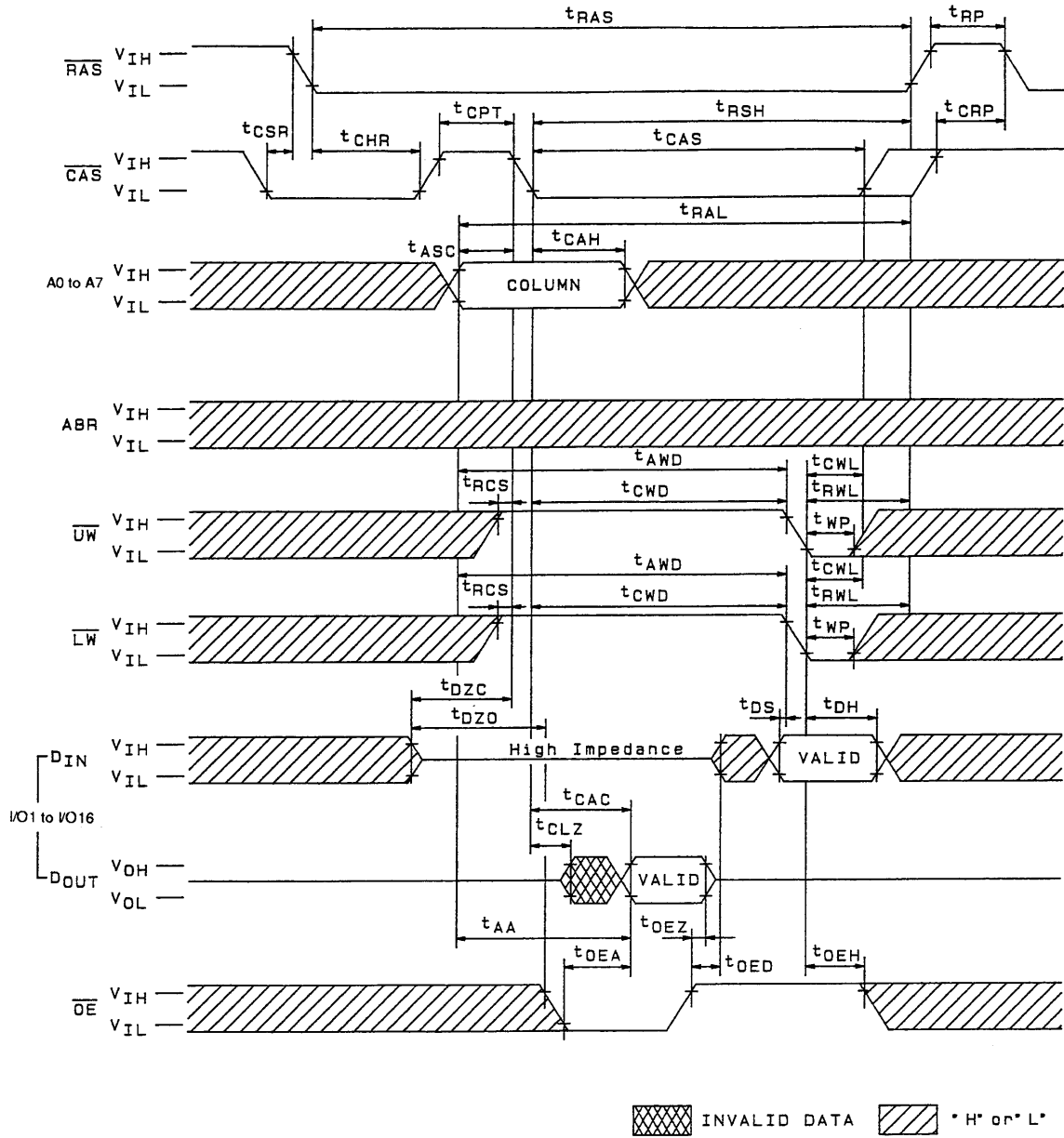
A02927

CAS-Before-RAS Refresh Counter Test Cycle (Write)



A0292B

CAS-Before-RAS Refresh Counter Test Cycle (Read-Modify-Write)



A02929

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use:
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of March, 1996. Specifications and information herein are subject to change without notice.