

MSM51V4265E**262,144-Word × 16-Bit DYNAMIC RAM : FAST PAGE MODE TYPE WITH EDO****DESCRIPTION**

The MSM51V4265E is a 262,144-word × 16-bit dynamic RAM fabricated in Oki's silicon-gate CMOS technology. The MSM51V4265E achieves high integration, high-speed operation, and low-power consumption because Oki manufactures the device in a quadruple-layer polysilicon/double-layer metal CMOS process. The MSM51V4265E is available in a 40-pin plastic SOJ or 44/40-pin plastic TSOP.

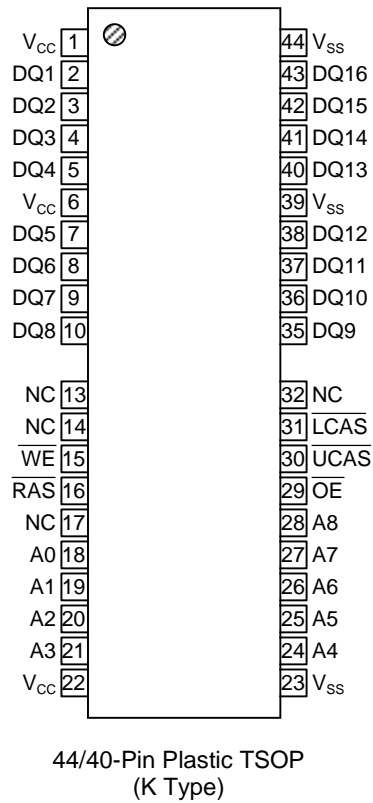
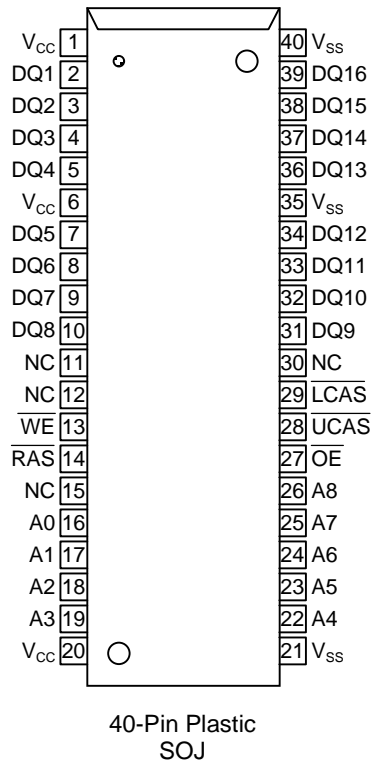
FEATURES

- 262,144-word × 16-bit configuration
 - Single 3.3V power supply, ±0.3V tolerance
 - Input : LVTTTL compatible, low input capacitance
 - Output : LVTTTL compatible, 3-state
 - Refresh : 512 cycles/8ms
 - Fast page mode with EDO, read modify write capability
 - $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, hidden refresh, $\overline{\text{RAS}}$ -only refresh capability
 - Packages
 - 40-pin 400mil plastic SOJ (SOJ40-P-400-1.27) (Product : MSM51V4265E-xxJS)
 - 44/40-pin 400mil plastic TSOP (TSOPII44/40-P-400-0.80-K) (Product : MSM51V4265E-xxTS-K)
- xx indicates speed rank.

PRODUCT FAMILY

Family	Access Time (Max.)				Cycle Time (Min.)	Power Dissipation	
	t _{RAC}	t _{AA}	t _{CAC}	t _{OEA}		Operating (Max.)	Standby (Max.)
MSM51V4265E	60ns	30ns	15ns	15ns	104ns	414mW	1.8mW
	70ns	35ns	20ns	20ns	124ns	378mW	

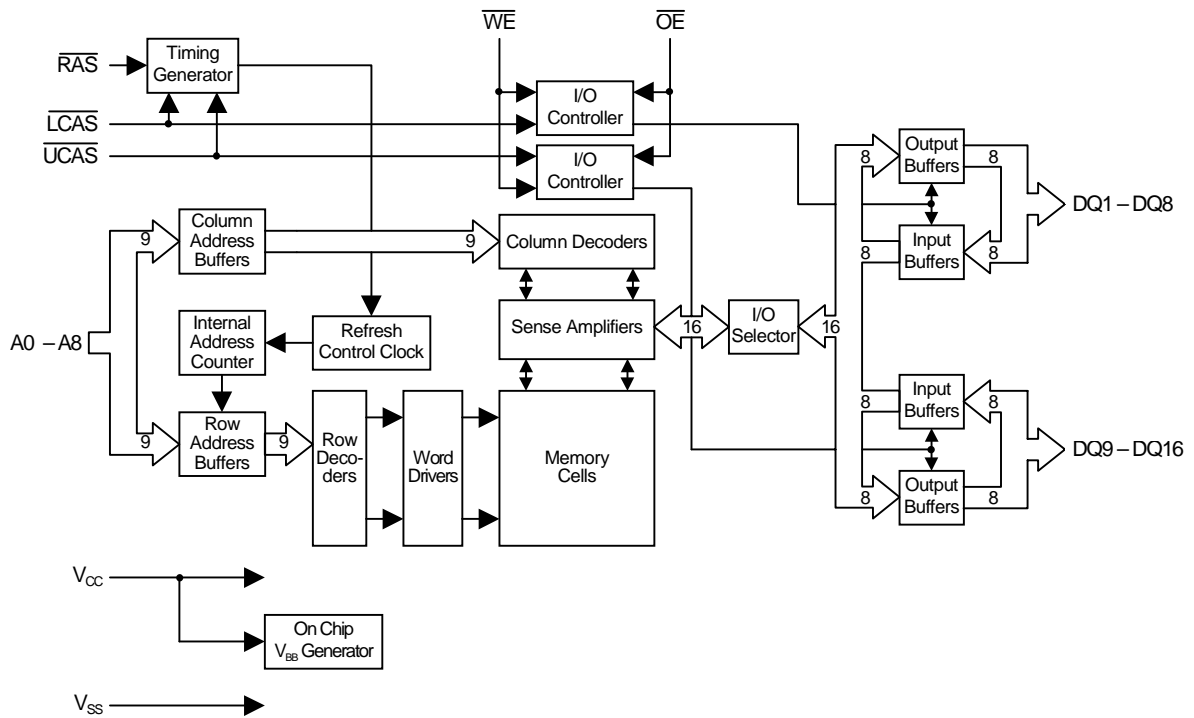
PIN CONFIGURATION (TOP VIEW)



Pin Name	Function
A0–A8	Address Input
\overline{RAS}	Row Address Strobe
\overline{LCAS}	Lower Byte Column Address Strobe
\overline{UCAS}	Upper Byte Column Address Strobe
DQ1–DQ16	Data Input/Data Output
\overline{OE}	Output Enable
\overline{WE}	Write Enable
V_{CC}	Power Supply (3.3V)
V_{SS}	Ground (0V)
NC	No Connection

Note : The same power supply voltage must be provided to every V_{CC} pin, and the same GND voltage level must be provided to every V_{SS} pin.

BLOCK DIAGRAM



FUNCTION TABLE

Input Pin					DQ Pin		Function Mode
$\overline{\text{RAS}}$	$\overline{\text{LCAS}}$	$\overline{\text{UCAS}}$	$\overline{\text{WE}}$	$\overline{\text{OE}}$	DQ1-DQ8	DQ9-DQ16	
H	*	*	*	*	High-Z	High-Z	Standby
L	H	H	*	*	High-Z	High-Z	Refresh
L	L	H	H	L	D _{OUT}	High-Z	Lower Byte Read
L	H	L	H	L	High-Z	D _{OUT}	Upper Byte Read
L	L	L	H	L	D _{OUT}	D _{OUT}	Word Read
L	L	H	L	H	D _{IN}	Don't Care	Lower Byte Write
L	H	L	L	H	Don't Care	D _{IN}	Upper Byte Write
L	L	L	L	H	D _{IN}	D _{IN}	Word Write
L	L	L	H	H	High-Z	High-Z	—

* : "H" or "L"

ELECTRICAL CHARACTERISTICS**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Value	Unit
Voltage on Any Pin Relative to V_{SS}	V_T	-1.0 to 4.6	V
Short Circuit Output Current	I_{OS}	50	mA
Power Dissipation	P_{D^*}	1	W
Operating Temperature	T_{opr}	0 to 70	°C
Storage Temperature	T_{stg}	-55 to 150	°C

*: $T_a = 25^\circ\text{C}$ **RECOMMENDED OPERATING CONDITIONS** $(T_a = 0 \text{ to } 70^\circ\text{C})$

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V
	V_{SS}	0	0	0	V
Input High Voltage	V_{IH}	2.0	—	$V_{CC} + 0.3$	V
Input Low Voltage	V_{IL}	-0.3	—	0.8	V

PIN CAPACITANCE $(V_{CC} = 3.3\text{V} \pm 0.3\text{V}, T_a = 25^\circ\text{C}, f = 1 \text{ MHz})$

Parameter	Symbol	Min.	Max.	Unit
Input Capacitance (A0 - A8)	C_{IN1}	—	6	pF
Input Capacitance (\overline{RAS} , \overline{LCAS} , \overline{UCAS} , \overline{WE} , \overline{OE})	C_{IN2}	—	7	pF
Output Capacitance (DQ1 - DQ16)	$C_{I/O}$	—	7	pF

DC CHARACTERISTICS

(V_{CC} = 3.3V ± 0.3V, T_a = 0 to 70°C)

Parameter	Symbol	Condition	MSM51V4265 E-60		MSM51V4265 E-70		Unit	Note
			Min.	Max.	Min.	Max.		
Output High Voltage	V _{OH}	I _{OH} = -2.0mA	2.4	V _{CC}	2.4	V _{CC}	V	
Output Low Voltage	V _{OL}	I _{OL} = 2mA	0	0.4	0	0.4	V	
Input Leakage Current	I _{LI}	0V ≤ V _I ≤ V _{CC} +0.3V; All other pins not under test = 0V	-10	10	-10	10	μA	
Output Leakage Current	I _{LO}	DQ disable 0V ≤ V _O ≤ V _{CC}	-10	10	-10	10	μA	
Average Power Supply Current (Operating)	I _{CC1}	$\overline{\text{RAS}}$, $\overline{\text{CAS}}$ cycling, t _{RC} = Min.	—	115	—	105	mA	1,2
Power Supply Current (Standby)	I _{CC2}	$\overline{\text{RAS}}$, $\overline{\text{CAS}}$ = V _{IH}	—	2	—	2	mA	1
		$\overline{\text{RAS}}$, $\overline{\text{CAS}}$ ≥ V _{CC} -0.2V	—	0.5	—	0.5		
Average Power Supply Current ($\overline{\text{RAS}}$ -only Refresh)	I _{CC3}	$\overline{\text{RAS}}$ cycling, $\overline{\text{CAS}}$ = V _{IH} , t _{RC} = Min.	—	115	—	105	mA	1,2
Power Supply Current (Standby)	I _{CC5}	$\overline{\text{RAS}}$ = V _{IH} , $\overline{\text{CAS}}$ = V _{IL} , DQ = enable	—	5	—	5	mA	1
Average Power Supply Current ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh)	I _{CC6}	$\overline{\text{RAS}}$ = cycling, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$	—	115	—	105	mA	1,2
Average Power Supply Current (Fast Page Mode)	I _{CC7}	$\overline{\text{RAS}}$ = V _{IL} , $\overline{\text{CAS}}$ cycling, t _{HPC} = Min.	—	115	—	105	mA	1,3

- Notes: 1. I_{CC} Max. is specified as I_{CC} for output open condition.
2. The address can be changed once or less while $\overline{\text{RAS}}$ = V_{IL}.
3. The address can be changed once or less while $\overline{\text{CAS}}$ = V_{IH}.

AC CHARACTERISTICS (1/2)

(V_{CC} = 3.3V ± 0.3V, Ta = 0 to 70°C) Note 1,2,3

Parameter	Symbol	MSM51V4265 E-60		MSM51V4265 E-70		Unit	Note
		Min.	Max.	Min.	Max.		
Random Read or Write Cycle Time	t _{RC}	104	—	124	—	ns	
Read Modify Write Cycle Time	t _{RWC}	135	—	160	—	ns	
Fast Page Mode Cycle Time	t _{HPC}	25	—	30	—	ns	
Fast Page Mode Read Modify Write Cycle Time	t _{HPRWC}	68	—	78	—	ns	
Access Time from $\overline{\text{RAS}}$	t _{RAC}	—	60	—	70	ns	4, 5, 6
Access Time from $\overline{\text{CAS}}$	t _{CAC}	—	15	—	20	ns	4,5
Access Time from Column Address	t _{AA}	—	30	—	35	ns	4,6
Access Time from $\overline{\text{CAS}}$ Precharge	t _{CPA}	—	35	—	40	ns	4,13
Access Time from $\overline{\text{OE}}$	t _{OEa}	—	15	—	20	ns	4
Output Low Impedance Time from $\overline{\text{CAS}}$	t _{CLZ}	0	—	0	—	ns	4
Data Output Hold After $\overline{\text{CAS}}$ Low	t _{DOH}	5	—	5	—	ns	
$\overline{\text{CAS}}$ to Data Output Buffer Turn-off Delay Time	t _{CEZ}	0	15	0	20	ns	7,8
$\overline{\text{RAS}}$ to Data Output Buffer Turn-off Delay Time	t _{REZ}	0	15	0	20	ns	7,8
$\overline{\text{OE}}$ to Data Output Buffer Turn-off Delay Time	t _{OEZ}	0	15	0	20	ns	7
$\overline{\text{WE}}$ to Data Output Buffer Turn-off Delay Time	t _{WEZ}	0	15	0	20	ns	7
Transition Time	t _T	1	50	1	50	ns	3
Refresh Period	t _{REF}	—	8	—	8	ms	
$\overline{\text{RAS}}$ Precharge Time	t _{RP}	40	—	50	—	ns	
$\overline{\text{RAS}}$ Pulse Width	t _{RAS}	60	10,000	70	10,000	ns	
$\overline{\text{RAS}}$ Pulse Width (Fast Page Mode with EDO)	t _{RASP}	60	100,000	70	100,000	ns	
$\overline{\text{RAS}}$ Hold Time	t _{RSH}	10	—	13	—	ns	
$\overline{\text{RAS}}$ Hold Time referenced to $\overline{\text{OE}}$	t _{ROH}	10	—	13	—	ns	
$\overline{\text{CAS}}$ Precharge Time (Fast Page Mode with EDO)	t _{CP}	10	—	10	—	ns	15
$\overline{\text{CAS}}$ Pulse Width	t _{CAS}	10	10,000	13	10,000	ns	
$\overline{\text{CAS}}$ Hold Time	t _{CSH}	40	—	45	—	ns	
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ Precharge Time	t _{CRP}	5	—	5	—	ns	13
$\overline{\text{RAS}}$ Hold Time from $\overline{\text{CAS}}$ Precharge	t _{RHCP}	35	—	40	—	ns	13
$\overline{\text{OE}}$ Hold Time from $\overline{\text{CAS}}$ (DQ Disable)	t _{CHO}	5	—	5	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Delay Time	t _{RCD}	14	45	14	50	ns	5
$\overline{\text{RAS}}$ to Column Address Delay Time	t _{RAD}	12	30	12	35	ns	6

AC CHARACTERISTICS (2/2)

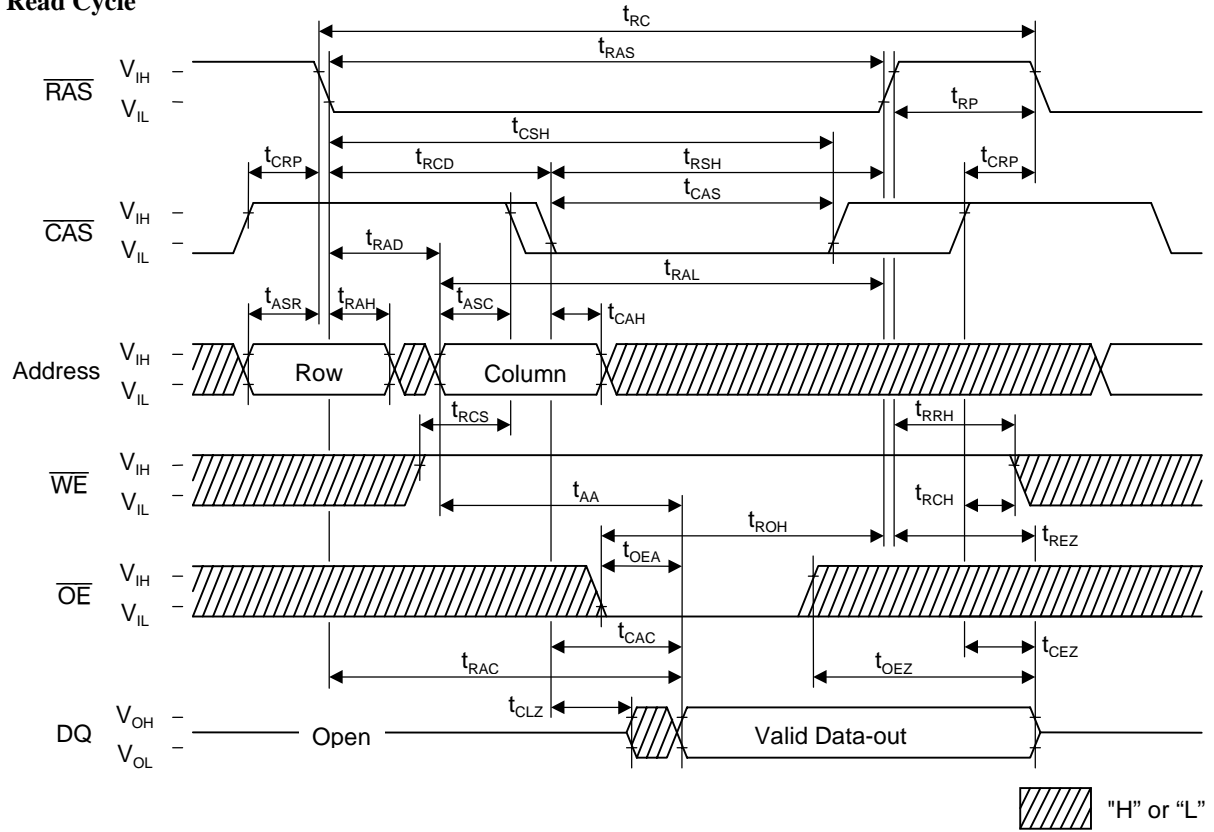
 $(V_{CC} = 3.3V \pm 0.3V, T_a = 0 \text{ to } 70^\circ\text{C})$ Note 1,2,3

Parameter	Symbol	MSM51V4265 E-60		MSM51V4265 E-70		Unit	Note
		Min.	Max.	Min.	Max.		
Row Address Set-up Time	t_{ASR}	0	—	0	—	ns	
Row Address Hold Time	t_{RAH}	10	—	10	—	ns	
Column Address Set-up Time	t_{ASC}	0	—	0	—	ns	12
Column Address Hold Time	t_{CAH}	10	—	13	—	ns	12
Column Address to \overline{RAS} Lead Time	t_{RAL}	30	—	35	—	ns	
Read Command Set-up Time	t_{RCS}	0	—	0	—	ns	12
Read Command Hold Time	t_{RCH}	0	—	0	—	ns	9,12
Read Command Hold Time referenced to \overline{RAS}	t_{RRH}	0	—	0	—	ns	9
Write Command Set-up Time	t_{WCS}	0	—	0	—	ns	10,12
Write Command Hold Time	t_{WCH}	10	—	13	—	ns	12
Write Command Pulse Width	t_{WP}	10	—	10	—	ns	
\overline{WE} Pulse Width (DQ Disable)	t_{WPE}	10	—	10	—	ns	
\overline{OE} Command Hold Time	t_{OEH}	10	—	13	—	ns	
\overline{OE} Precharge Time	t_{OEP}	10	—	10	—	ns	
\overline{OE} Command Hold Time	t_{OCH}	10	—	10	—	ns	
Write Command to \overline{RAS} Lead Time	t_{RWL}	10	—	13	—	ns	
Write Command to \overline{CAS} Lead Time	t_{CWL}	10	—	13	—	ns	14
Data-in Set-up Time	t_{DS}	0	—	0	—	ns	11,12
Data-in Hold Time	t_{DH}	10	—	13	—	ns	11,12
\overline{OE} to Data-in Delay Time	t_{OED}	15	—	20	—	ns	
\overline{CAS} to \overline{WE} Delay Time	t_{CWD}	35	—	45	—	ns	10
Column Address to \overline{WE} Delay Time	t_{AWD}	50	—	60	—	ns	10
\overline{RAS} to \overline{WE} Delay Time	t_{RWD}	80	—	95	—	ns	10
\overline{CAS} Precharge \overline{WE} Delay Time	t_{CPWD}	55	—	65	—	ns	10
\overline{CAS} Active Delay Time from \overline{RAS} Precharge	t_{RPC}	5	—	5	—	ns	12
\overline{RAS} to \overline{CAS} Set-up Time (\overline{CAS} before \overline{RAS})	t_{CSR}	5	—	5	—	ns	12
\overline{RAS} to \overline{CAS} Hold Time (\overline{CAS} before \overline{RAS})	t_{CHR}	10	—	10	—	ns	13

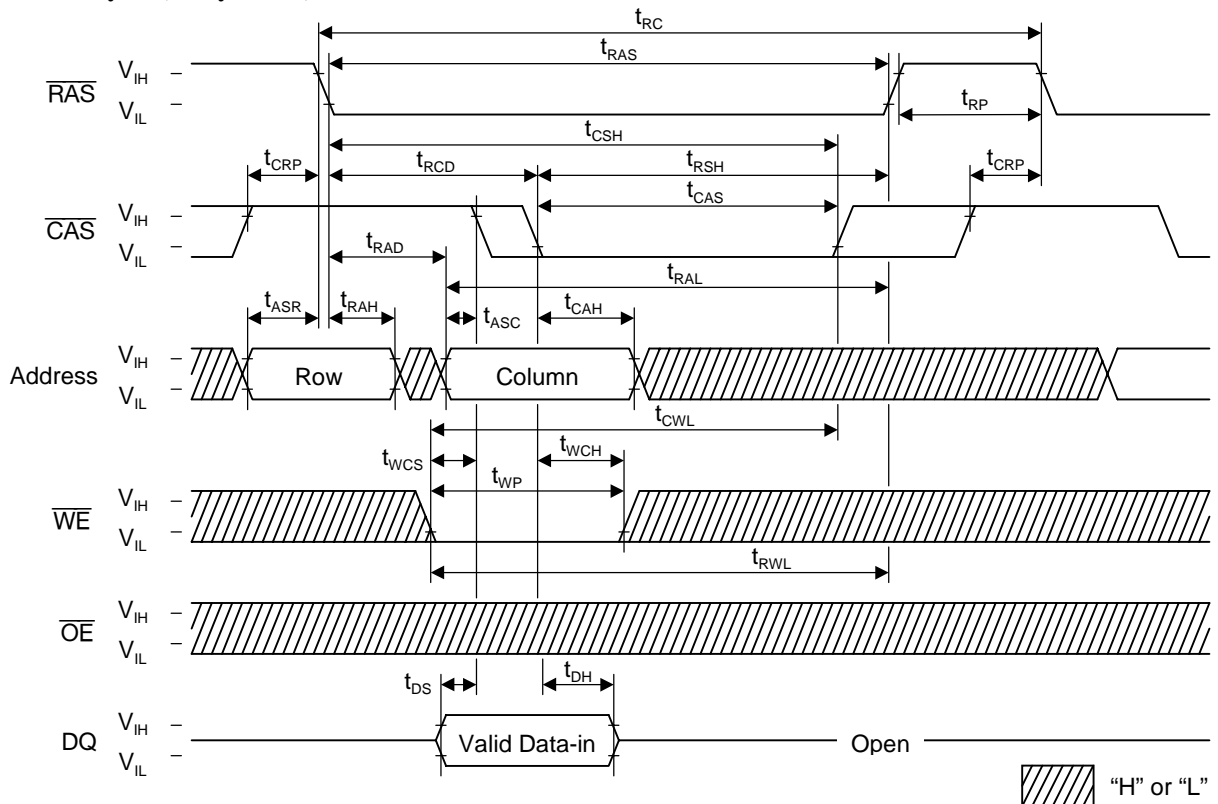
- Notes:
1. A start-up delay of 200 μ s is required after power-up, followed by a minimum of eight initialization cycles ($\overline{\text{RAS}}$ -only refresh or $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh) before proper device operation is achieved.
 2. The AC characteristics assume $t_T = 2\text{ns}$.
 3. V_{IH} (Min.) and V_{IL} (Max.) are reference levels for measuring input timing signals. Transition times (t_T) are measured between V_{IH} and V_{IL} .
 4. This parameter is measured with a load circuit equivalent to 1 TTL load and 50pF. The output timing reference levels are $V_{OH}=2.0$ ($I_{OH} = -2\text{mA}$) and $V_{OL}=0.8\text{V}$ ($I_{OL} = 2\text{mA}$).
 5. Operation within the t_{RCD} (Max.) limit ensures 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 the access time is controlled by t_{CAC} .
 6. Operation within the t_{RAD} (Max.) limit ensures 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 the access time is controlled by t_{AA} .
 7. t_{CEZ} (Max.), t_{REZ} (Max.), t_{WEZ} (Max.), and t_{OEZ} (Max.) define the time at which the output achieved the open circuit condition and are not referenced to output voltage levels.
 8. t_{CEZ} , and t_{REZ} must be satisfied for open circuit condition.
 9. t_{RCH} or t_{RRH} must be satisfied for a read cycle.
 10. t_{WCS} , t_{CWD} , t_{RWD} , t_{AWD} and t_{CPWD} are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If $t_{WCS} \geq t_{WCS}$ (Min.), then the cycle is an early write cycle and the data out will remain open circuit (high impedance) throughout the entire cycle. If $t_{CWD} \geq t_{CWD}$ (Min.), $t_{RWD} \geq t_{RWD}$ (Min.), $t_{AWD} \geq t_{AWD}$ (Min.) and $t_{CPWD} \geq t_{CPWD}$ (Min.), then the cycle is a read modify write cycle and data out will contain data read from the selected cell; if neither of the above sets of conditions is satisfied, then the condition of the data out (at access time) is indeterminate.
 11. These parameters are referenced to the $\overline{\text{UCAS}}$ and $\overline{\text{LCAS}}$, leading edges in an early write cycle, and to the $\overline{\text{WE}}$ leading edge in an $\overline{\text{OE}}$ control write cycle, or a read modify write cycle.
 12. These parameters are determined by the falling edge of either $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$, whichever is earlier.
 13. These parameters are determined by the rising edge of either $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$, whichever is later.
 14. t_{CWL} should be satisfied by both $\overline{\text{UCAS}}$ and $\overline{\text{LCAS}}$.
 15. t_{CP} is determined by the time both $\overline{\text{UCAS}}$ and $\overline{\text{LCAS}}$ are high.

TIMING CHART

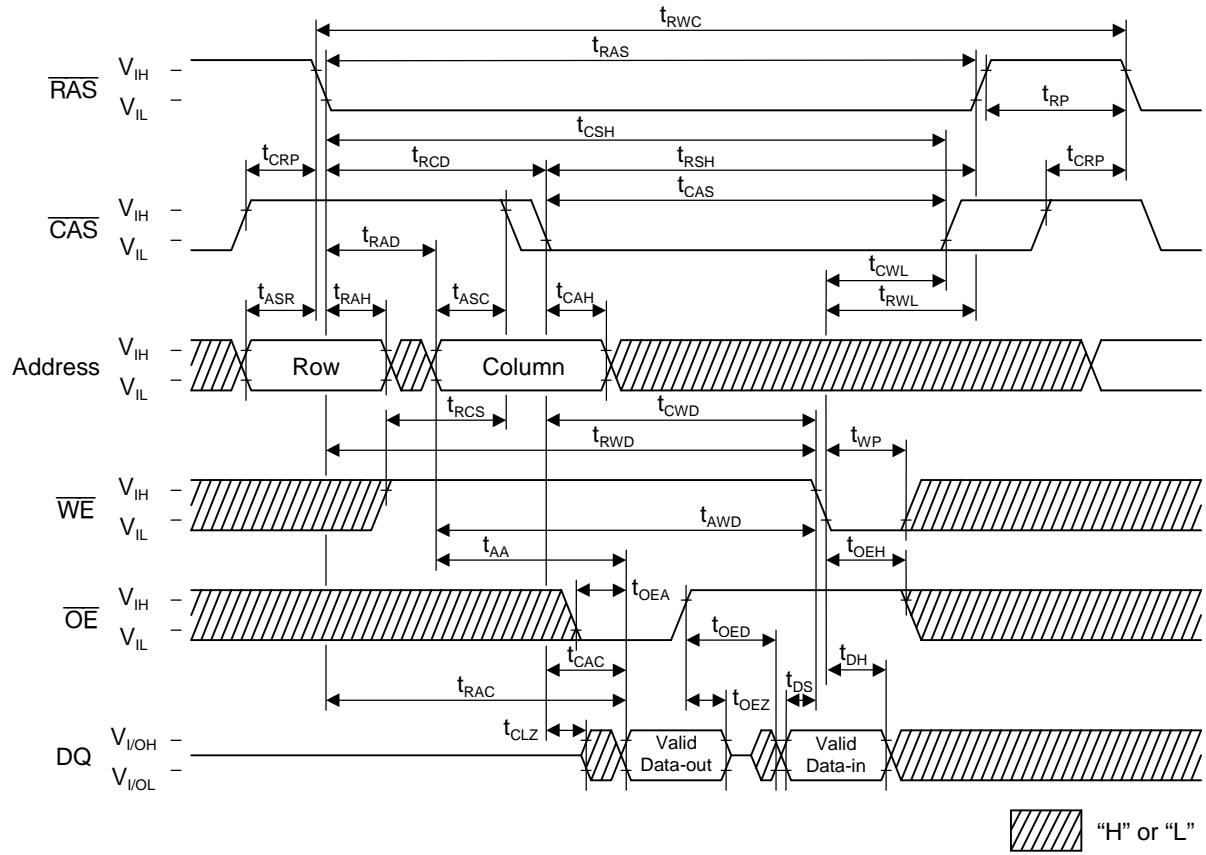
Read Cycle



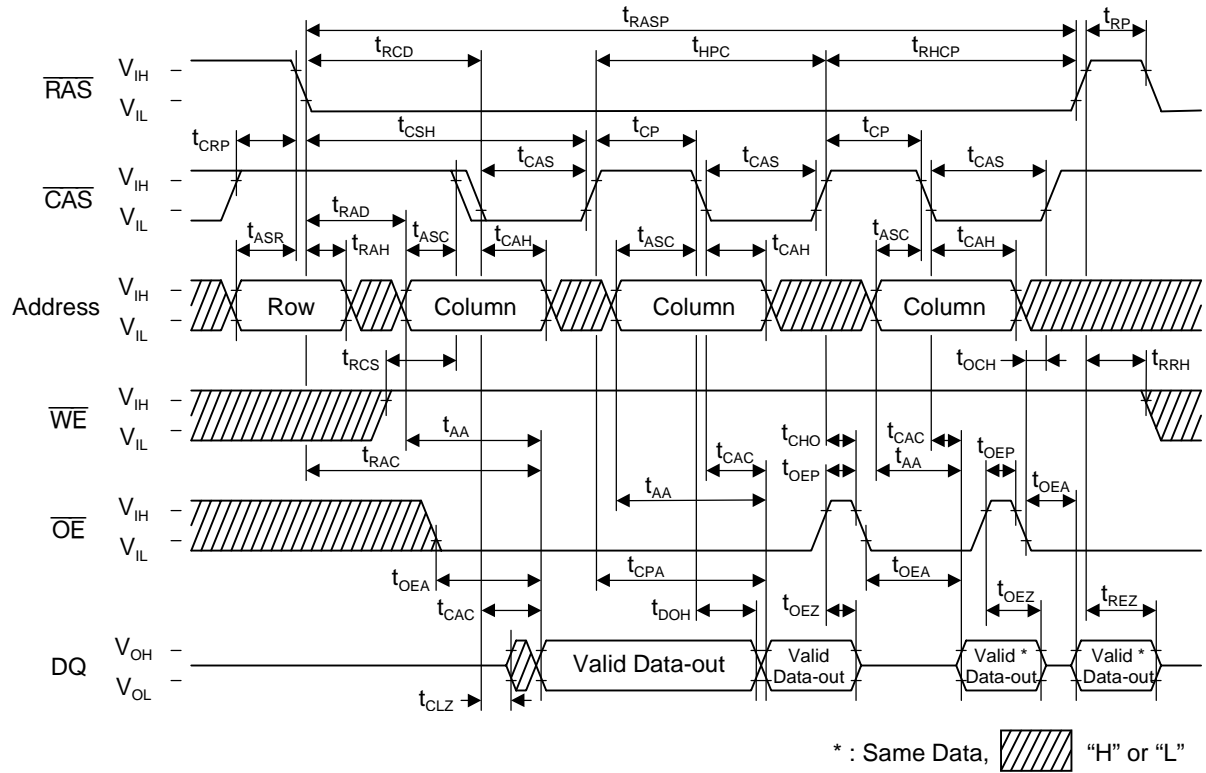
Write Cycle (Early Write)



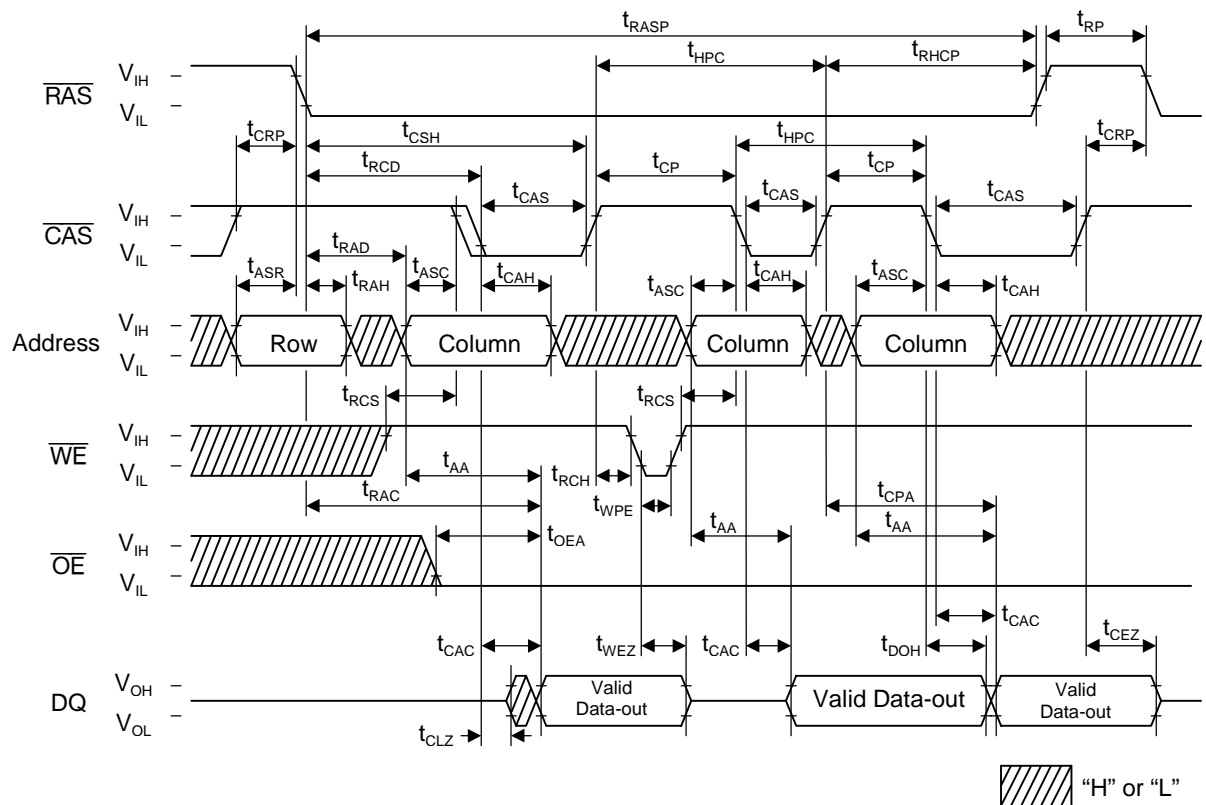
Read Modify Write Cycle



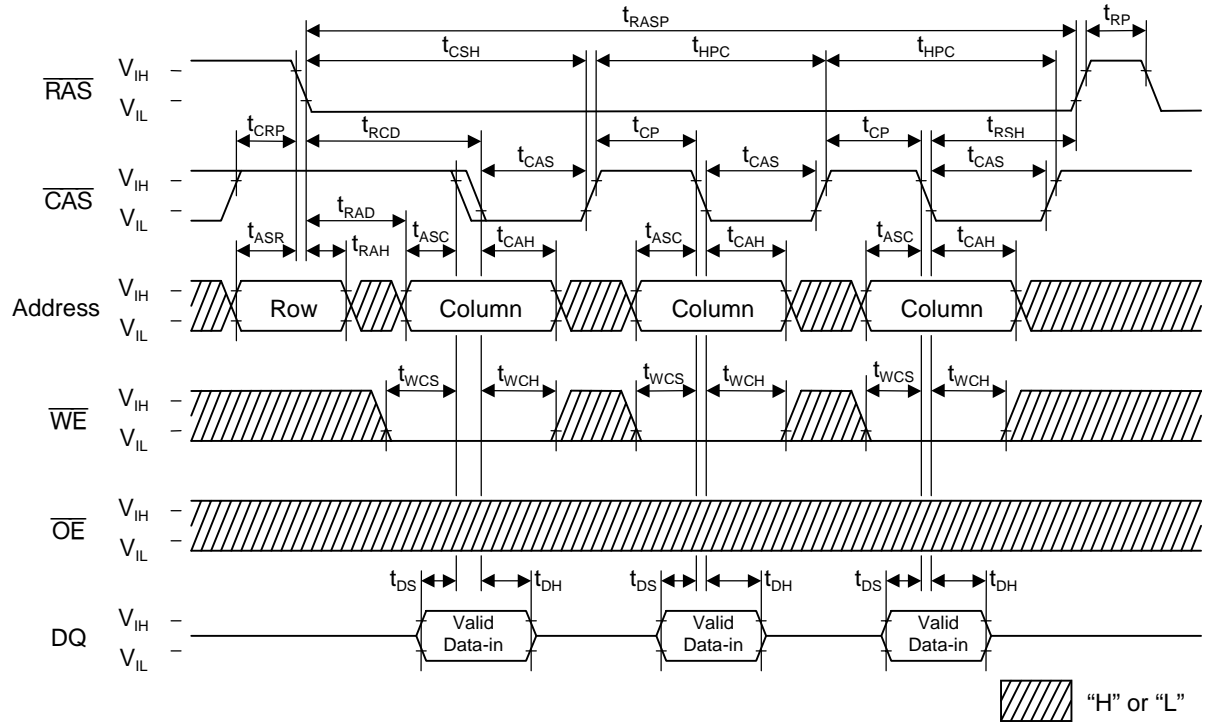
Fast Page Mode Read Cycle (Part-1)



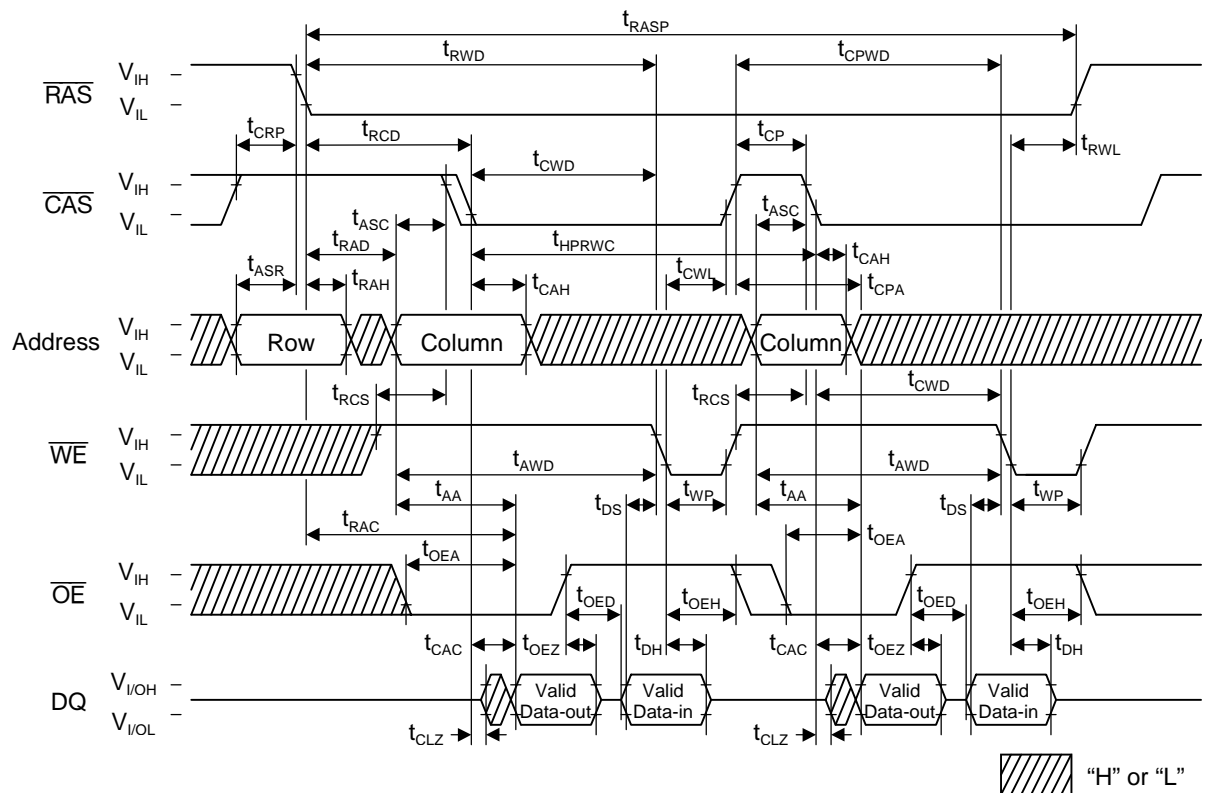
Fast Page Mode Read Cycle (Part-2)



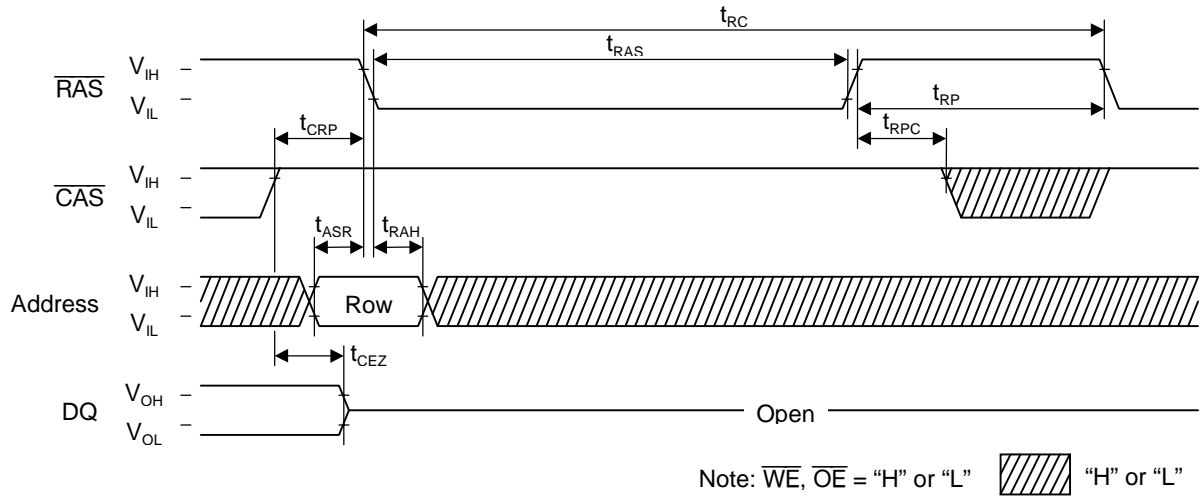
Fast Page Mode Write Cycle (Early Write)



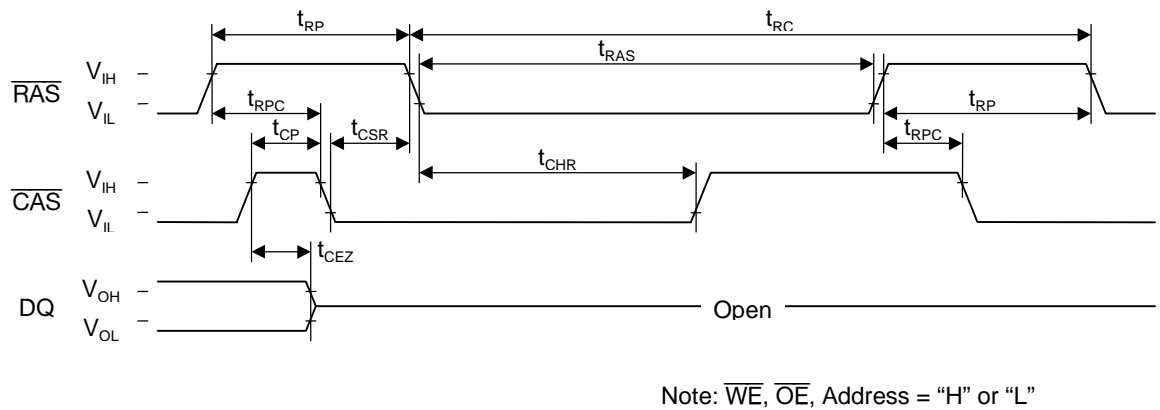
Fast Page Mode Read Modify Write Cycle



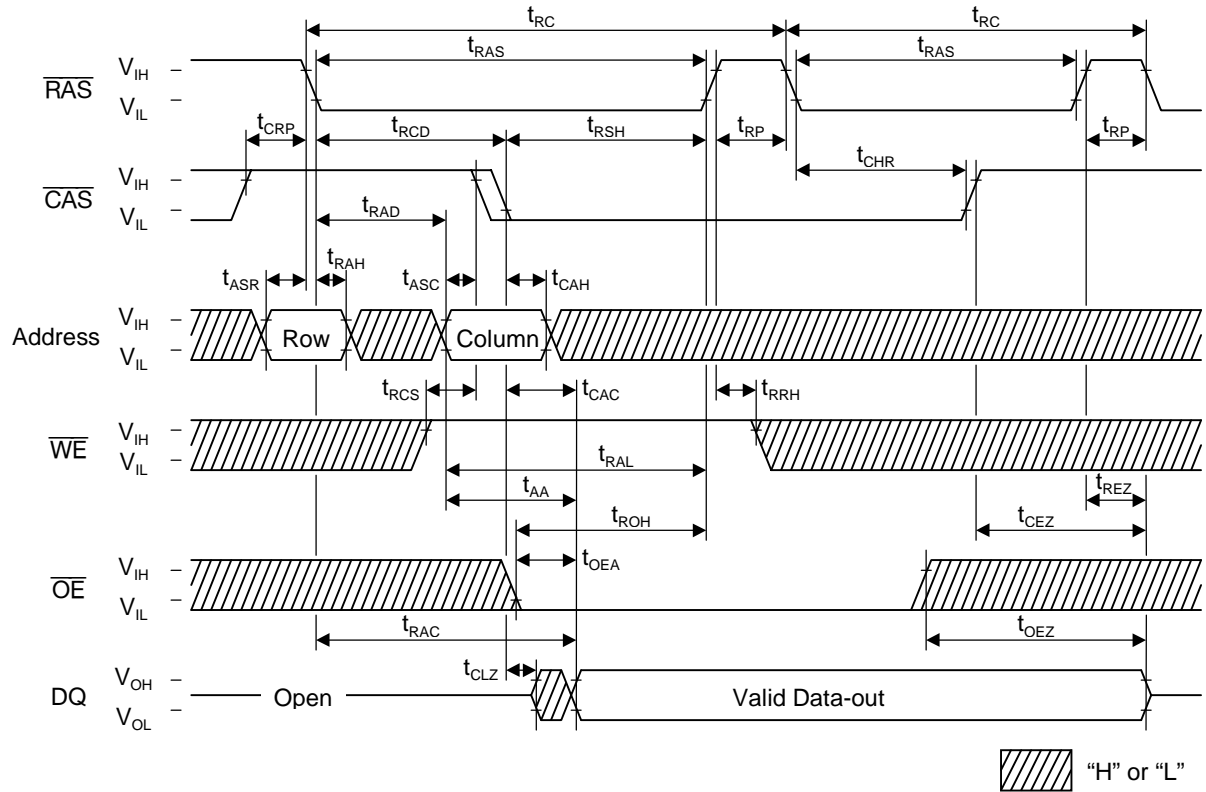
$\overline{\text{RAS}}$ -only Refresh Cycle



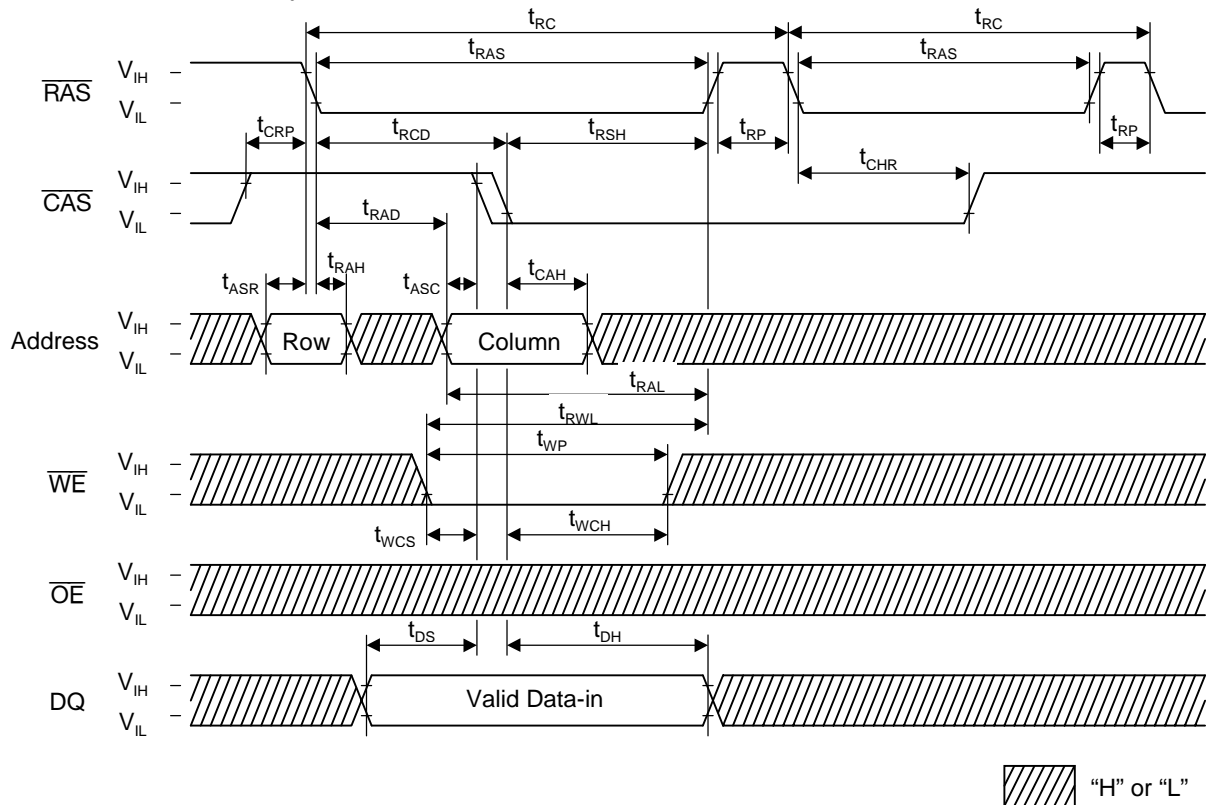
$\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh Cycle



Hidden Refresh Read Cycle



Hidden Refresh Write Cycle



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