

MSM5117805F**2,097,152-Word × 8-Bit DYNAMIC RAM : FAST PAGE MODE TYPE WITH EDO****DESCRIPTION**

The MSM5117805F is a 2,097,152-word × 8-bit dynamic RAM fabricated in Oki's silicon-gate CMOS technology. The MSM5117805F 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 MSM5117805F is available in a 28-pin plastic SOJ or 28-pin plastic TSOP.

FEATURES

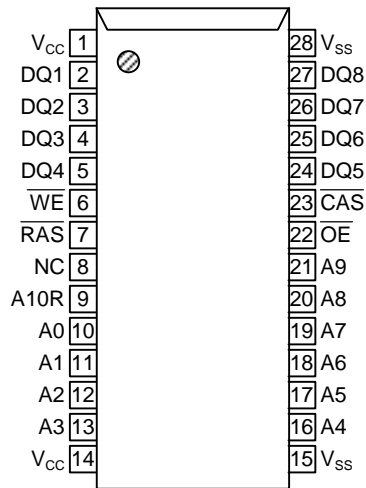
- 2,097,152-word × 8-bit configuration
 - Single 5V power supply, ±10% tolerance
 - Input : TTL compatible, low input capacitance
 - Output : TTL compatible, 3-state
 - Refresh : 2048 cycles/32ms
 - Fast page mode with EDO, read modify write capability
 - $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh, hidden refresh, $\overline{\text{RAS}}$ -only refresh capability
 - Packages

28-pin 400mil plastic SOJ	(SOJ28-P-400-1.27)	(Product : MSM5117805F-xxJS)
28-pin 400mil plastic TSOP	(TSOPII28-P-400-1.27-K)	(Product : MSM5117805F-xxTS-K)
- xx indicates speed rank.

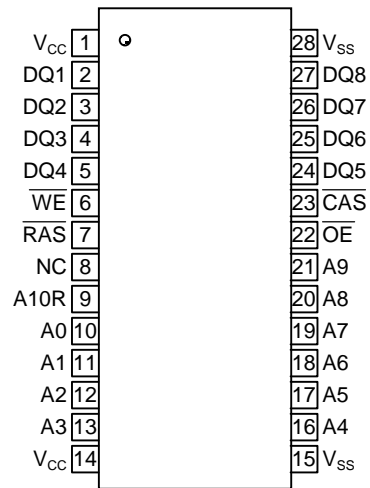
PRODUCT FAMILY

Family	Access Time (Max.)				Cycle Time (Min.)	Power Dissipation	
	t_{RAC}	t_{AA}	t_{CAC}	t_{OEA}		Operating (Max.)	Standby (Max.)
MSM5117805F	50ns	25ns	13ns	13ns	84ns	550mW	5.5mW
	60ns	30ns	15ns	15ns	104ns	495mW	
	70ns	35ns	20ns	20ns	124ns	440mW	

PIN CONFIGURATION (TOP VIEW)



28-Pin Plastic SOJ

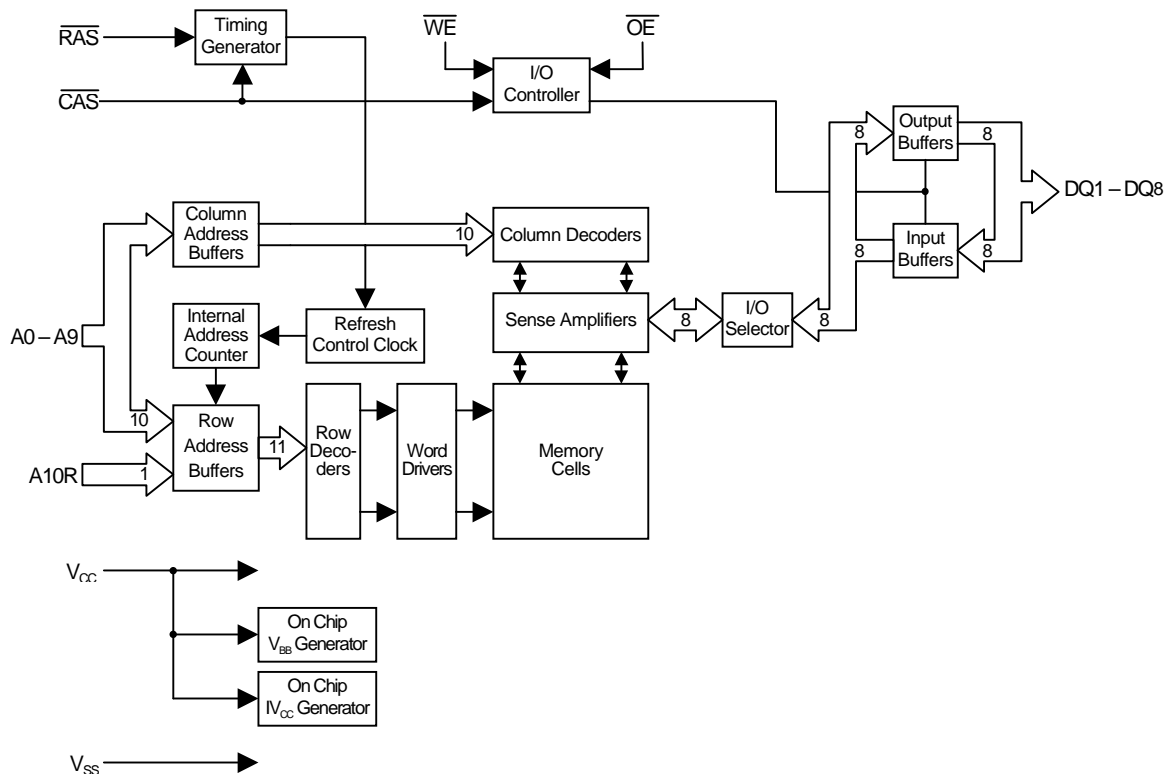


28-Pin Plastic TSOP
(K Type)

Pin Name	Function
A0–A9, A10R	Address Input
$\overline{\text{RAS}}$	Row Address Strobe
$\overline{\text{CAS}}$	Column Address Strobe
DQ1–DQ8	Data Input/Data Output
$\overline{\text{OE}}$	Output Enable
$\overline{\text{WE}}$	Write Enable
V_{CC}	Power Supply (5V)
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



ELECTRICAL CHARACTERISTICS**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Value	Unit
Voltage on Any Pin Relative V_{SS}	V_{IN}, V_{OUT}	-0.5 to $V_{CC}+0.5$	V
Voltage V_{CC} Supply relative to V_{SS}	V_{CC}	-0.5 to 7.0	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 CONDITION**

(Ta = 0 to 70°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{CC}	4.5	5.0	5.5	V
	V_{SS}	0	0	0	V
Input High Voltage	V_{IH}	2.4	—	$V_{CC} + 0.5^{*1}$	V
Input Low Voltage	V_{IL}	-0.5 ^{*2}	—	0.8	V

Notes: *1. The input voltage is $V_{CC} + 2.0\text{V}$ when the pulse width is less than 20ns (the pulse width is with respect to the point at which V_{CC} is applied).

*2. The input voltage is $V_{SS} - 2.0\text{V}$ when the pulse width is less than 20ns (the pulse width respect to the point at which V_{SS} is applied).

PIN CAPACITANCE

(Vcc = 5V ± 10%, Ta = 25°C, f = 1 MHz)

Parameter	Symbol	Min.	Max.	Unit
Input Capacitance (A0 – A9, A10R)	C_{IN1}	—	5	pF
Input Capacitance ($\overline{\text{RAS}}$, $\overline{\text{CAS}}$, $\overline{\text{WE}}$, $\overline{\text{OE}}$)	C_{IN2}	—	7	pF
Output Capacitance (DQ1 – DQ8)	$C_{I/O}$	—	7	pF

DC CHARACTERISTICS

(V_{CC} = 5V ± 10%, T_a = 0 to 70°C)

Parameter	Symbol	Condition	MSM5117805 F-50		MSM5117805 F-60		MSM5117805 F-70		Unit	Note
			Min.	Max.	Min.	Max.	Min.	Max.		
Output High Voltage	V _{OH}	I _{OH} = -5.0mA	2.4	V _{CC}	2.4	V _{CC}	2.4	V _{CC}	V	
Output Low Voltage	V _{OL}	I _{OL} = 4.2mA	0	0.4	0	0.4	0	0.4	V	
Input Leakage Current	I _{LI}	0V ≤ V _I ≤ 6.5V; All other pins not under test = 0V	- 10	10	- 10	10	- 10	10	μA	
Output Leakage Current	I _{LO}	DQ disable 0V ≤ V _O ≤ V _{CC}	- 10	10	- 10	10	- 10	10	μA	
Average Power Supply Current (Operating)	I _{CC1}	$\overline{\text{RAS}}$, $\overline{\text{CAS}}$ cycling, t _{RC} = Min.	—	100	—	90	—	80	mA	1,2
Power Supply Current (Standby)	I _{CC2}	$\overline{\text{RAS}}$, $\overline{\text{CAS}} = V_{IH}$	—	2	—	2	—	2	mA	1
		$\overline{\text{RAS}}$, $\overline{\text{CAS}} \geq V_{CC} - 0.2V$	—	1	—	1	—	1		
Average Power Supply Current ($\overline{\text{RAS}}$ -only Refresh)	I _{CC3}	$\overline{\text{RAS}}$ cycling, $\overline{\text{CAS}} = V_{IH}$, t _{RC} = Min.	—	100	—	90	—	80	mA	1,2
Power Supply Current (Standby)	I _{CC5}	$\overline{\text{RAS}} = V_{IH}$, $\overline{\text{CAS}} = V_{IL}$, DQ = enable	—	5	—	5	—	5	mA	1
Average Power Supply Current ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ Refresh)	I _{CC6}	$\overline{\text{RAS}} = \text{cycling}$, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$	—	100	—	90	—	80	mA	1,2
Average Power Supply Current (Fast Page Mode)	I _{CC7}	$\overline{\text{RAS}} = V_{IL}$, $\overline{\text{CAS}}$ cycling, t _{HPC} = Min.	—	100	—	90	—	80	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 (1/3)

(V_{CC} = 5V ± 10%, Ta = 0 to 70°C) Note1,2,3

Parameter	Symbol	MSM5117805 F-50		MSM5117805 F-60		MSM5117805 F-70		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
Random Read or Write Cycle Time	t _{RC}	84	—	104	—	124	—	ns	
Read Modify Write Cycle Time	t _{RWC}	110	—	135	—	160	—	ns	
Fast Page Mode Cycle Time	t _{HPC}	20	—	25	—	30	—	ns	
Fast Page Mode Read Modify Write Cycle Time	t _{HPRWC}	58	—	68	—	78	—	ns	
Access Time from $\overline{\text{RAS}}$	t _{RAC}	—	50	—	60	—	70	ns	4, 5, 6
Access Time from $\overline{\text{CAS}}$	t _{CAC}	—	13	—	15	—	20	ns	4,5
Access Time from Column Address	t _{AA}	—	25	—	30	—	35	ns	4,6
Access Time from $\overline{\text{CAS}}$ Precharge	t _{CPA}	—	30	—	35	—	40	ns	4
Access Time from $\overline{\text{OE}}$	t _{OEA}	—	13	—	15	—	20	ns	4
Output Low Impedance Time from $\overline{\text{CAS}}$	t _{CLZ}	0	—	0	—	0	—	ns	4
Data Output Hold After $\overline{\text{CAS}}$ Low	t _{DOH}	5	—	5	—	5	—	ns	
$\overline{\text{CAS}}$ to Data Output Buffer Turn-off Delay Time	t _{CEZ}	0	13	0	15	0	20	ns	7,8
$\overline{\text{RAS}}$ to Data Output Buffer Turn-off Delay Time	t _{REZ}	0	13	0	15	0	20	ns	7,8
$\overline{\text{OE}}$ to Data Output Buffer Turn-off Delay Time	t _{OEZ}	0	13	0	15	0	20	ns	7
$\overline{\text{WE}}$ to Data Output Buffer Turn-off Delay Time	t _{WEZ}	0	13	0	15	0	20	ns	7
Transition Time	t _T	1	50	1	50	1	50	ns	3
Refresh Period	t _{REF}	—	32	—	32	—	32	ms	
$\overline{\text{RAS}}$ Precharge Time	t _{RP}	30	—	40	—	50	—	ns	
$\overline{\text{RAS}}$ Pulse Width	t _{RAS}	50	10,000	60	10,000	70	10,000	ns	
$\overline{\text{RAS}}$ Pulse Width (Fast Page Mode with EDO)	t _{RASP}	50	100,000	60	100,000	70	100,000	ns	
$\overline{\text{RAS}}$ Hold Time	t _{RSH}	7	—	10	—	13	—	ns	
$\overline{\text{RAS}}$ Hold Time referenced to $\overline{\text{OE}}$	t _{ROH}	7	—	10	—	13	—	ns	
$\overline{\text{CAS}}$ Precharge Time (Fast Page Mode with EDO)	t _{CP}	7	—	10	—	10	—	ns	
$\overline{\text{CAS}}$ Pulse Width	t _{CAS}	7	10,000	10	10,000	13	10,000	ns	
$\overline{\text{CAS}}$ Hold Time	t _{CSH}	35	—	40	—	45	—	ns	

AC CHARACTERISTICS (2/3)

(V_{CC} = 5V ± 10%, Ta = 0 to 70°C) Note1,2,3

Parameter	Symbol	MSM5117805 F-50		MSM5117805 F-60		MSM5117805 F-70		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
$\overline{\text{CAS}}$ to $\overline{\text{RAS}}$ Precharge Time	t _{CRP}	5	—	5	—	5	—	ns	
$\overline{\text{RAS}}$ Hold Time from $\overline{\text{CAS}}$ Precharge	t _{RHCP}	30	—	35	—	40	—	ns	
$\overline{\text{OE}}$ Hold Time from $\overline{\text{CAS}}$ (DQ Disable)	t _{CHO}	5	—	5	—	5	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Delay Time	t _{RCD}	11	37	14	45	14	50	ns	5
$\overline{\text{RAS}}$ to Column Address Delay Time	t _{RAD}	9	25	12	30	12	35	ns	6
Row Address Set-up Time	t _{ASR}	0	—	0	—	0	—	ns	
Row Address Hold Time	t _{RAH}	7	—	10	—	10	—	ns	
Column Address Set-up Time	t _{ASC}	0	—	0	—	0	—	ns	
Column Address Hold Time	t _{CAH}	7	—	10	—	13	—	ns	
Column Address to $\overline{\text{RAS}}$ Lead Time	t _{RAL}	25	—	30	—	35	—	ns	
Read Command Set-up Time	t _{RCS}	0	—	0	—	0	—	ns	
Read Command Hold Time	t _{RCH}	0	—	0	—	0	—	ns	9
Read Command Hold Time referenced to $\overline{\text{RAS}}$	t _{RRH}	0	—	0	—	0	—	ns	9
Write Command Set-up Time	t _{WCS}	0	—	0	—	0	—	ns	10
Write Command Hold Time	t _{WCH}	7	—	10	—	13	—	ns	
Write Command Pulse Width	t _{WP}	7	—	10	—	10	—	ns	
$\overline{\text{WE}}$ Pulse Width (DQ Disable)	t _{WPE}	7	—	10	—	10	—	ns	
$\overline{\text{OE}}$ Command Hold Time	t _{OEH}	7	—	10	—	13	—	ns	
$\overline{\text{OE}}$ Precharge Time	t _{OEP}	7	—	10	—	10	—	ns	
$\overline{\text{OE}}$ Command Hold Time	t _{OCH}	7	—	10	—	10	—	ns	
Write Command to $\overline{\text{RAS}}$ Lead Time	t _{RWL}	7	—	10	—	13	—	ns	
Write Command to $\overline{\text{CAS}}$ Lead Time	t _{CWL}	7	—	10	—	13	—	ns	
Data-in Set-up Time	t _{DS}	0	—	0	—	0	—	ns	11
Data-in Hold Time	t _{DH}	7	—	10	—	13	—	ns	11
$\overline{\text{OE}}$ to Data-in Delay Time	t _{OED}	13	—	15	—	20	—	ns	
$\overline{\text{CAS}}$ to $\overline{\text{WE}}$ Delay Time	t _{CWD}	30	—	34	—	44	—	ns	10
Column Address to $\overline{\text{WE}}$ Delay Time	t _{AWD}	42	—	49	—	59	—	ns	10
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Delay Time	t _{RWD}	67	—	79	—	94	—	ns	10
$\overline{\text{CAS}}$ Precharge $\overline{\text{WE}}$ Delay Time	t _{CPWD}	47	—	54	—	64	—	ns	10

AC CHARACTERISTICS (3/3)

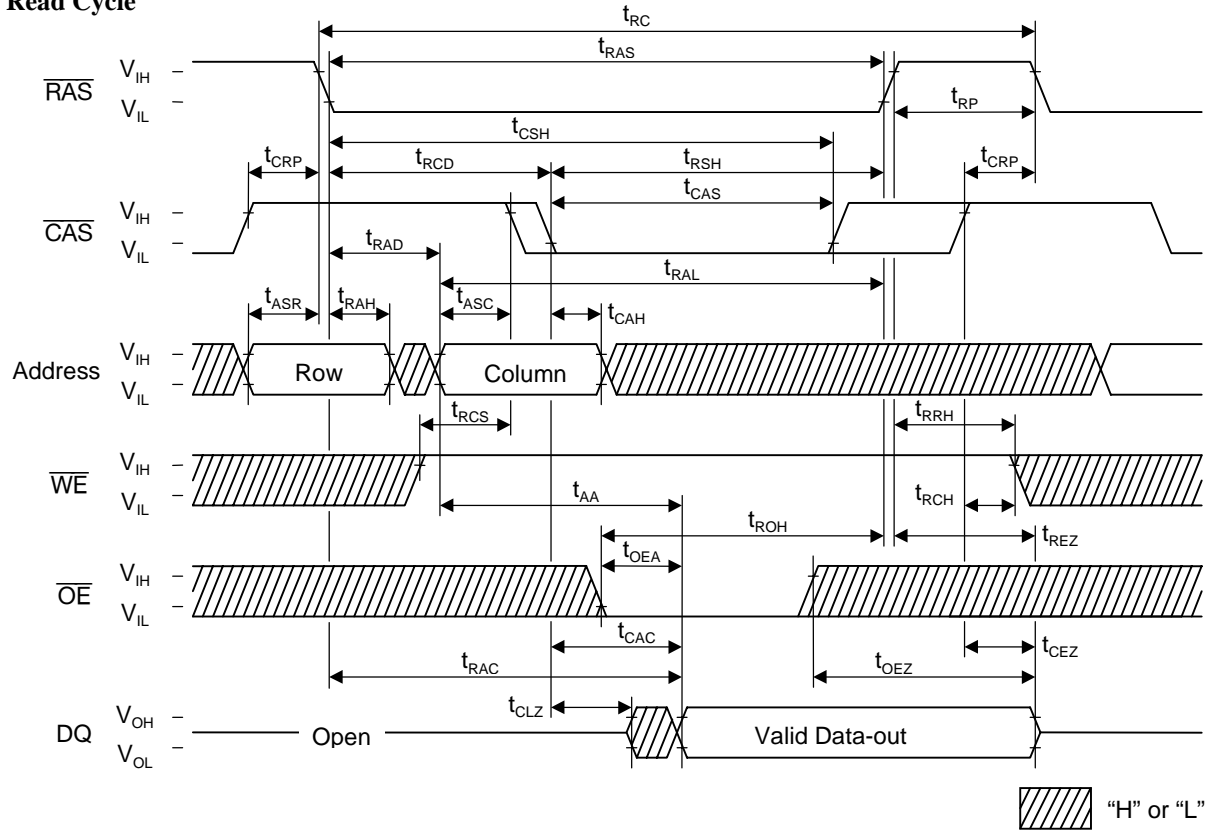
(V_{CC} = 3.3V ± 0.3V, Ta = 0 to 70°C) Note1,2,3

Parameter	Symbol	MSM5117805 F-50		MSM5117805 F-60		MSM5117805 F-70		Unit	Note
		Min.	Max.	Min.	Max.	Min.	Max.		
$\overline{\text{CAS}}$ Active Delay Time from $\overline{\text{RAS}}$ Precharge	t _{RPC}	5	—	5	—	5	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Set-up Time ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$)	t _{CSR}	5	—	5	—	5	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{CAS}}$ Hold Time ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$)	t _{CHR}	10	—	10	—	10	—	ns	
$\overline{\text{WE}}$ to $\overline{\text{CAS}}$ Hold Time ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$)	t _{WRP}	10	—	10	—	10	—	ns	
$\overline{\text{WE}}$ Hold Time from $\overline{\text{RAS}}$ ($\overline{\text{CAS}}$ before $\overline{\text{RAS}}$)	t _{WRH}	10	—	10	—	10	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Set-up Time	t _{WTS}	10	—	10	—	10	—	ns	
$\overline{\text{RAS}}$ to $\overline{\text{WE}}$ Hold Time	t _{WTH}	10	—	10	—	10	—	ns	

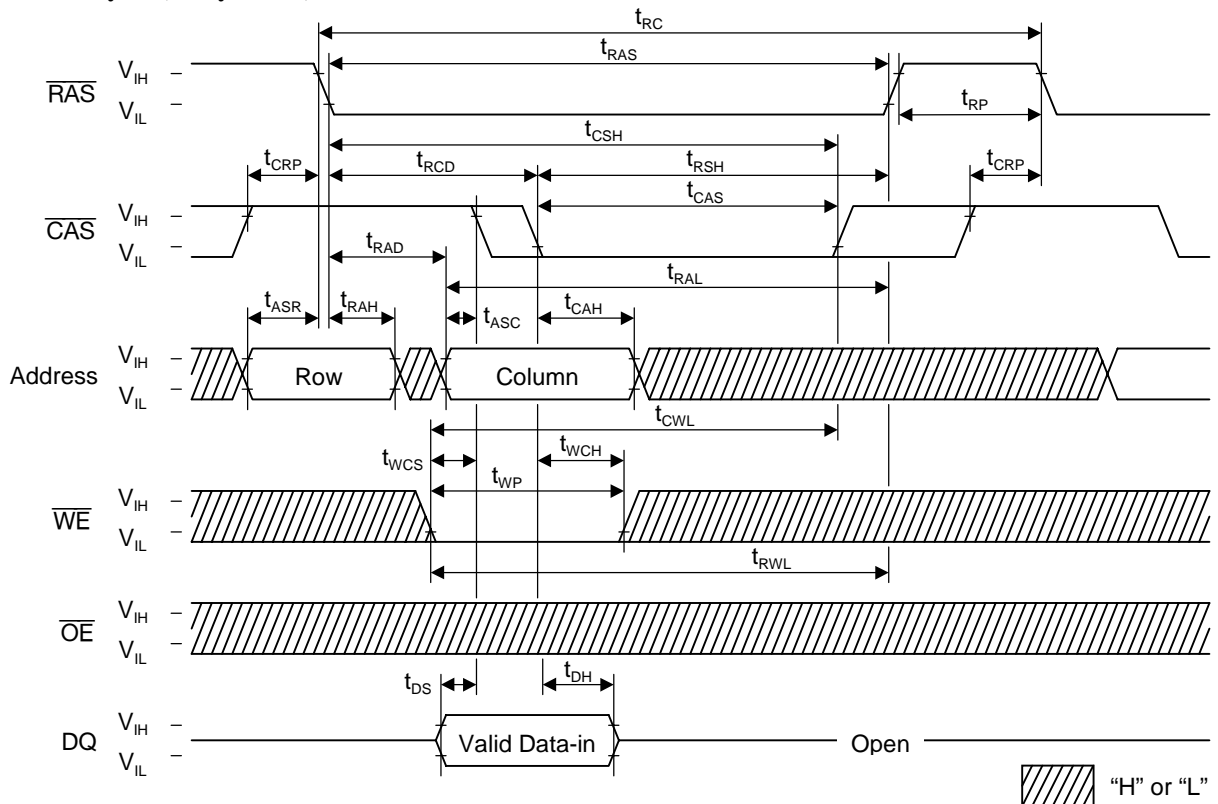
- Notes:
1. A start-up delay of 200 μ s is required after power-up, followed by a minimum of eight initialization cycles ($\overline{\text{RAS}}$ -only refresh or $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$ refresh) before proper device operation is achieved.
 2. The AC characteristics assume $t_T = 2\text{ns}$.
 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. -50 is measured with a load circuit equivalent to 2TTL load and 50pF, and -60/-70 is measured with a load circuit equivalent to 2TTL load and 100pF.
 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 $\overline{\text{CAS}}$, 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.

TIMING CHART

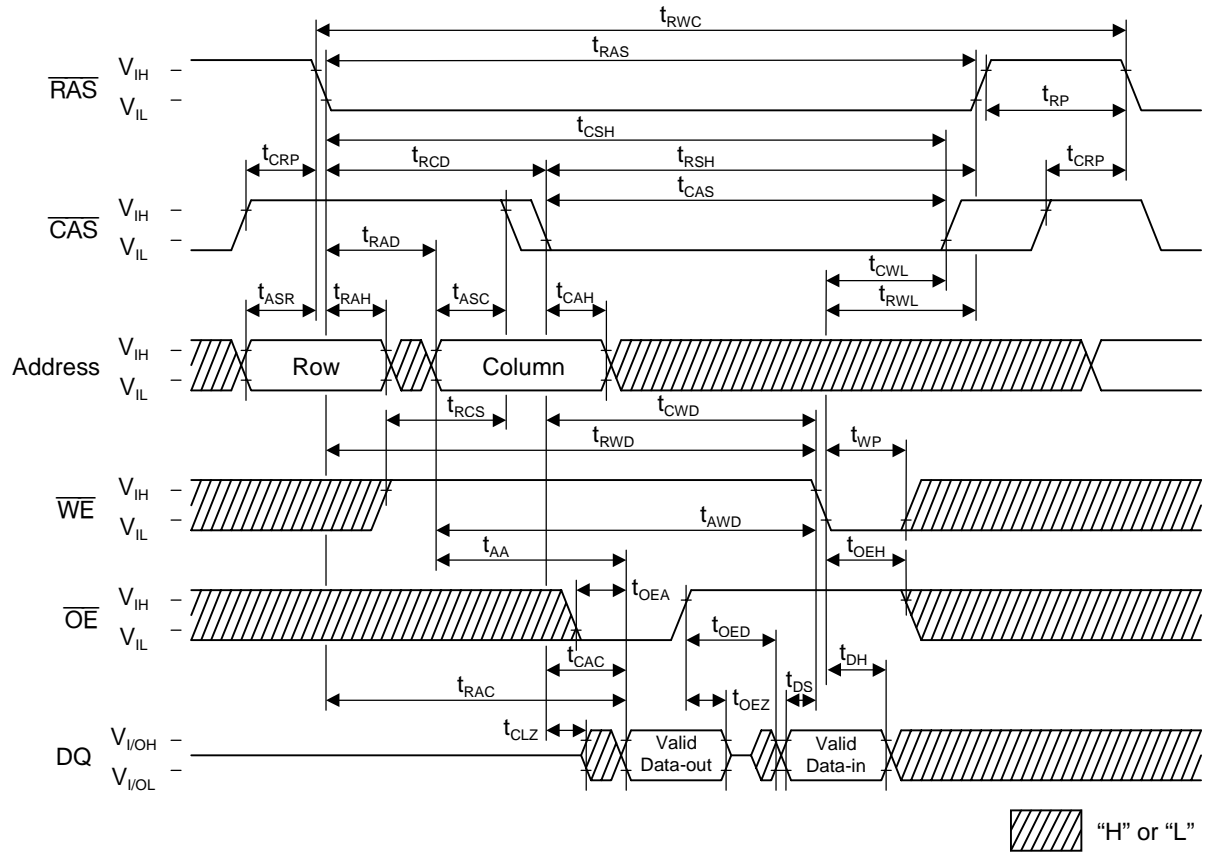
Read Cycle



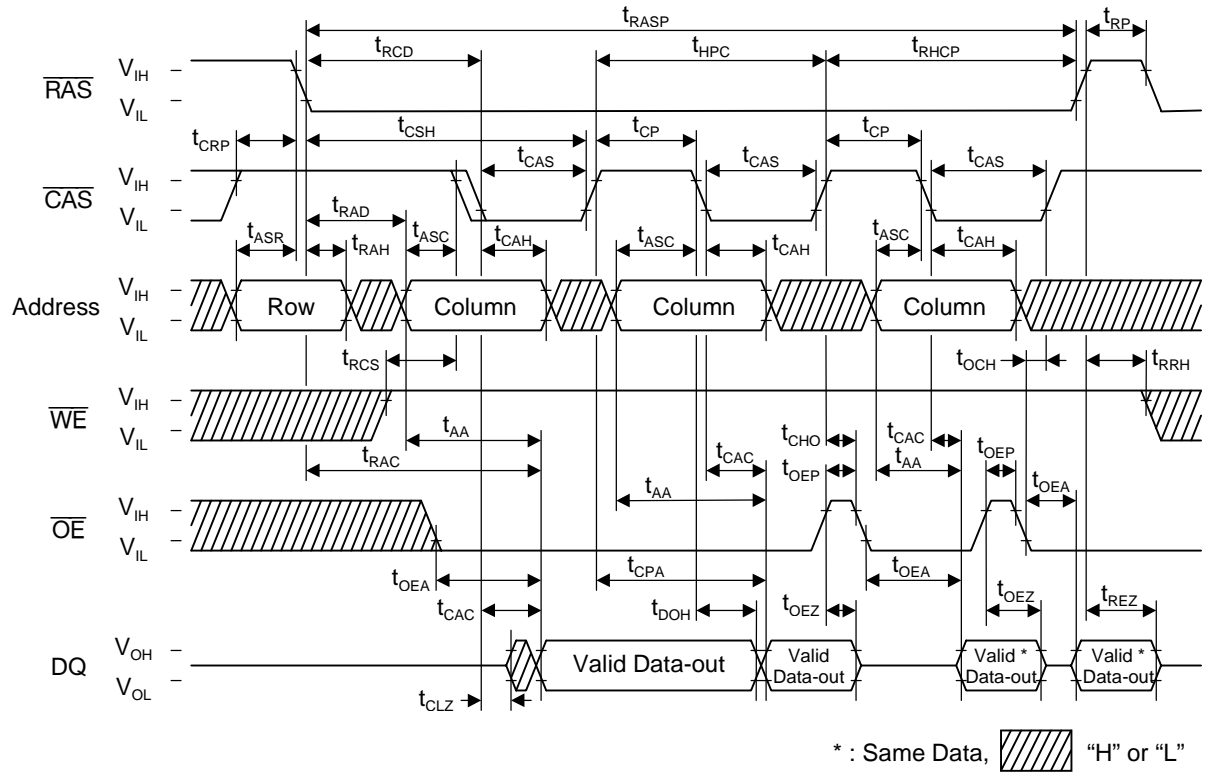
Write Cycle (Early Write)



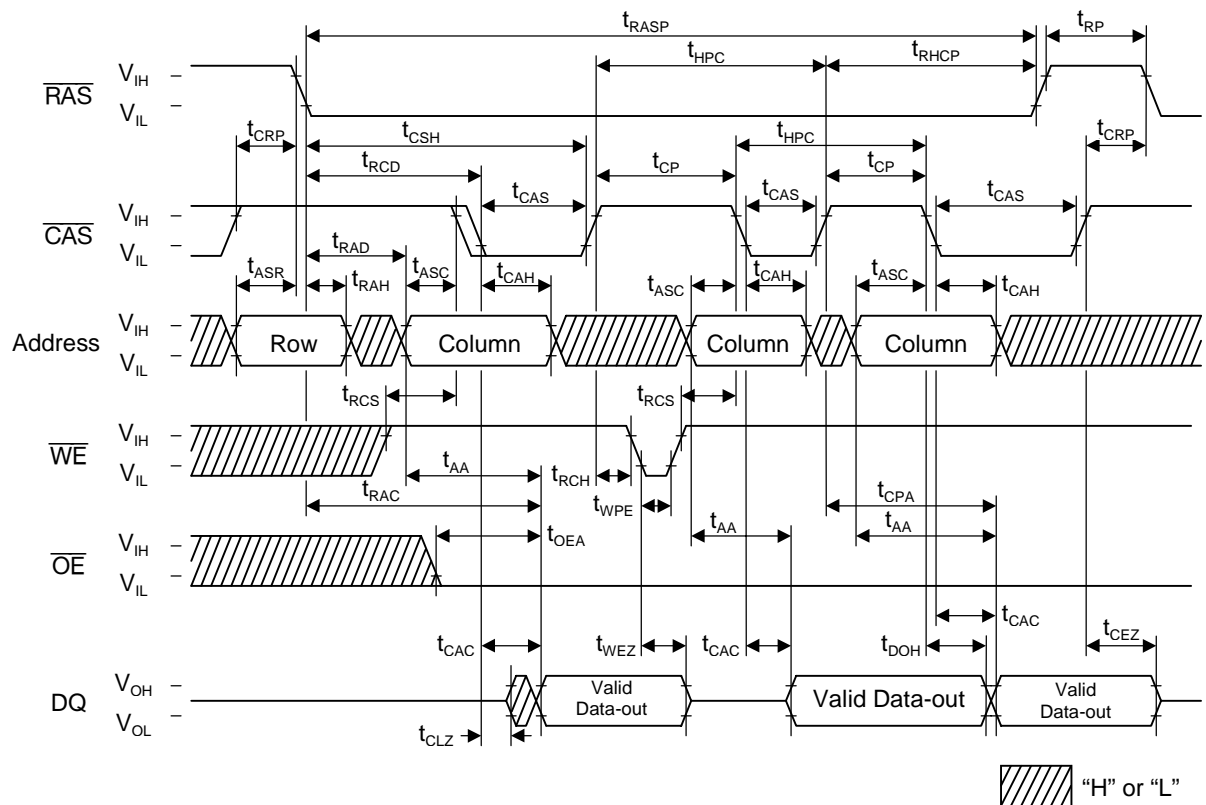
Read Modify Write Cycle



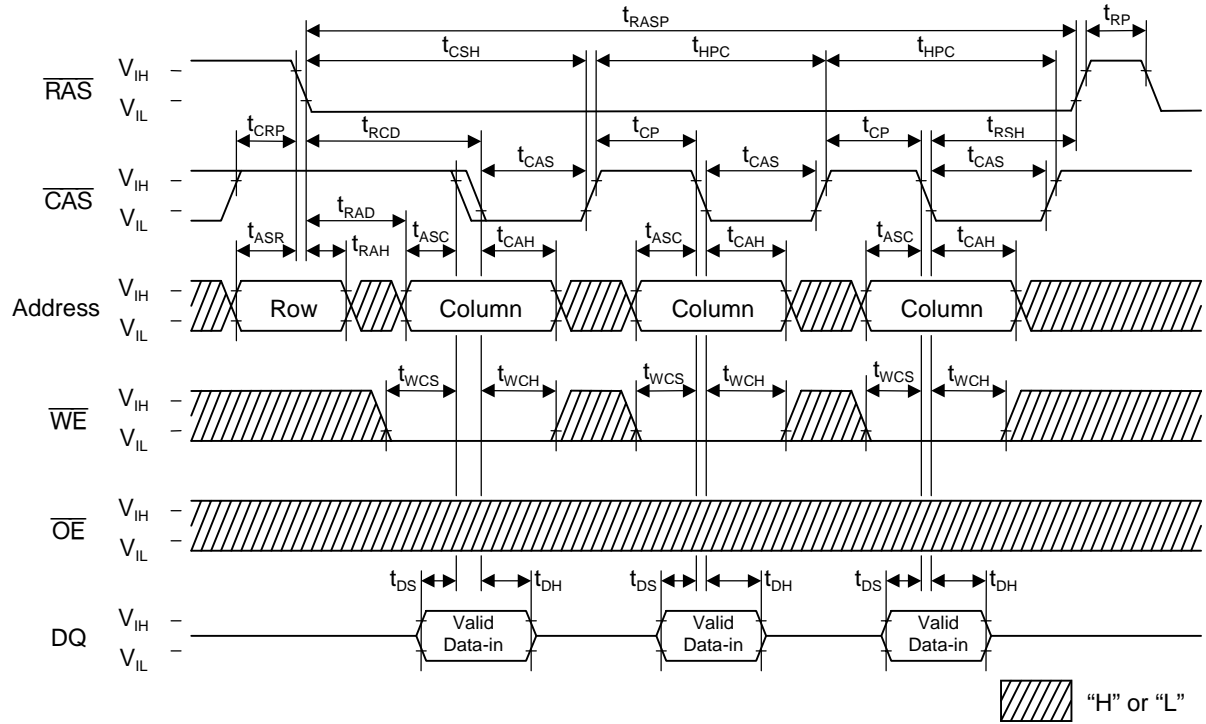
Fast Page Mode Read Cycle (Part-1)



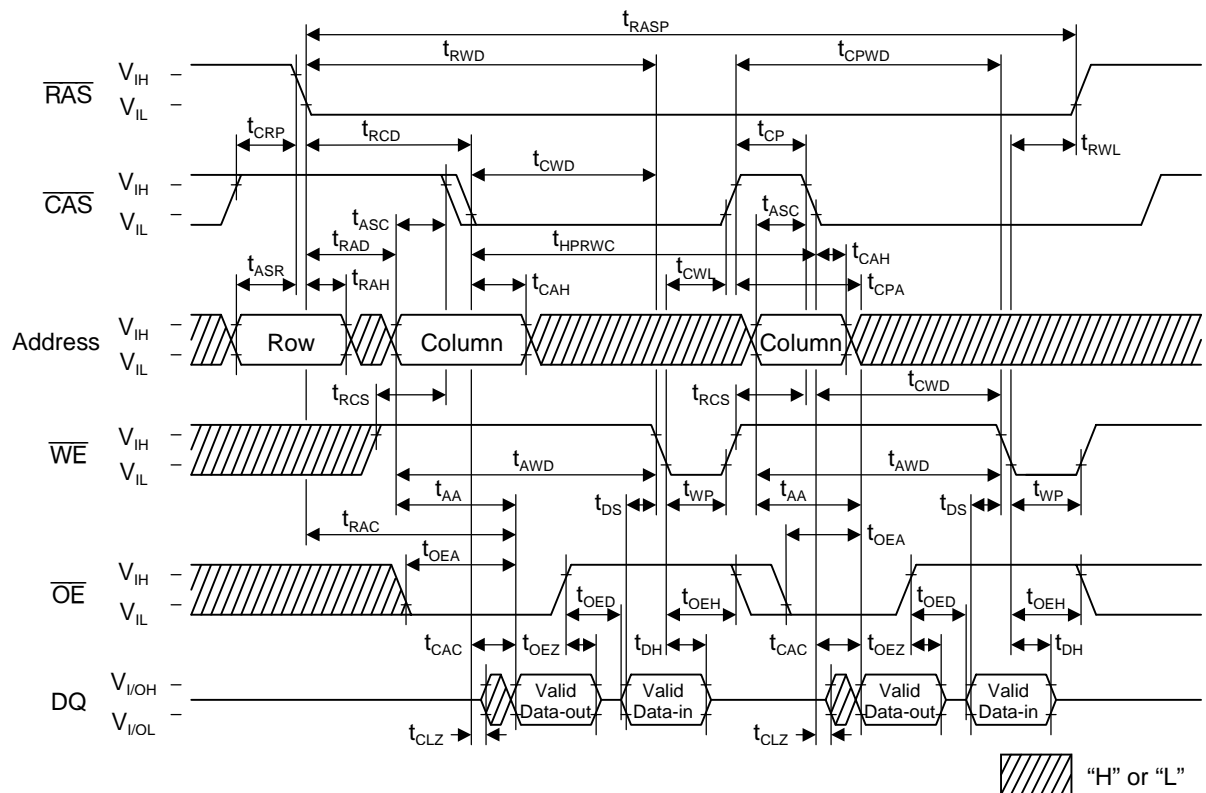
Fast Page Mode Read Cycle (Part-2)



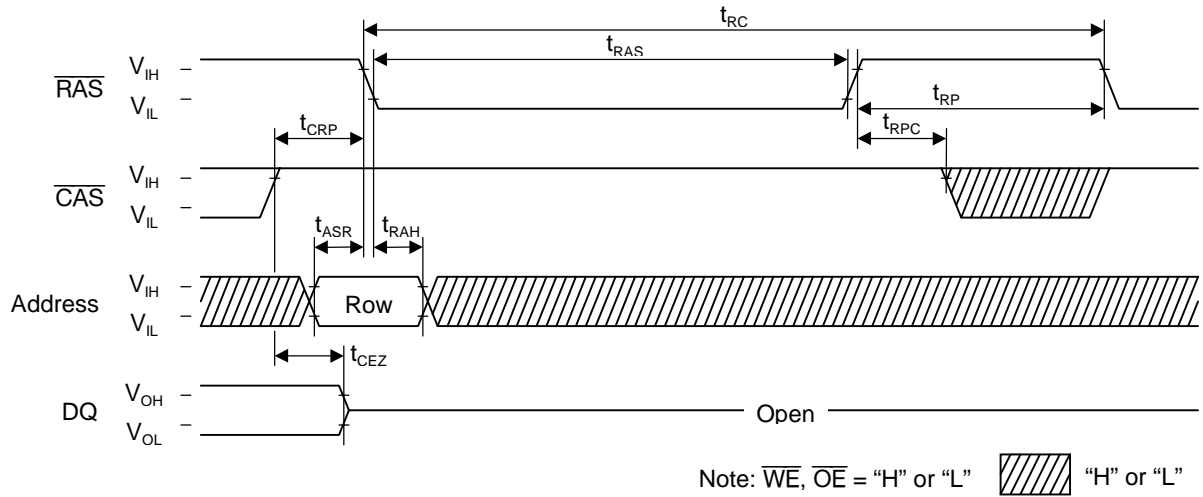
Fast Page Mode Write Cycle (Early Write)



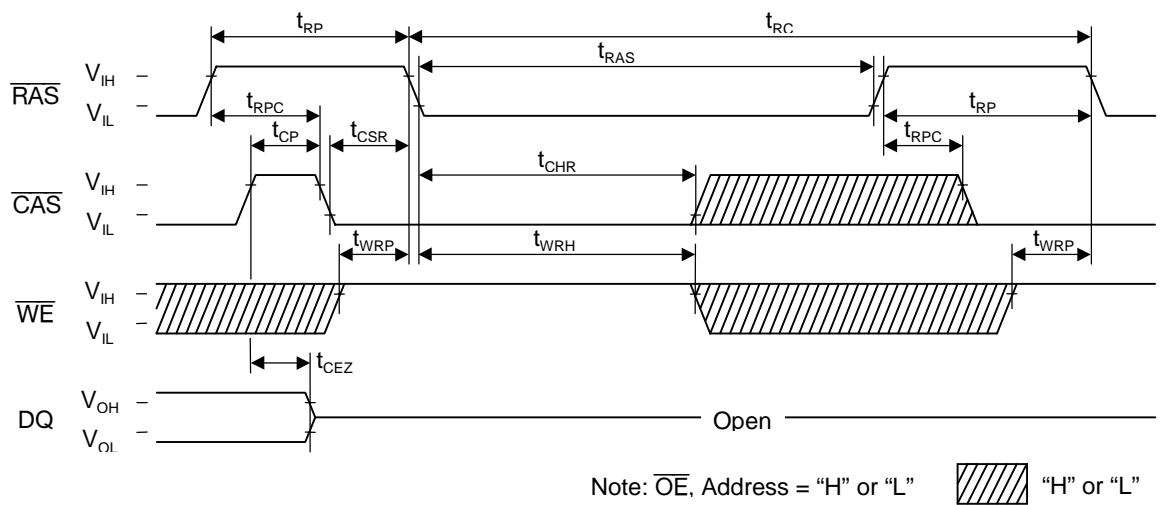
Fast Page Mode Read Modify Write Cycle



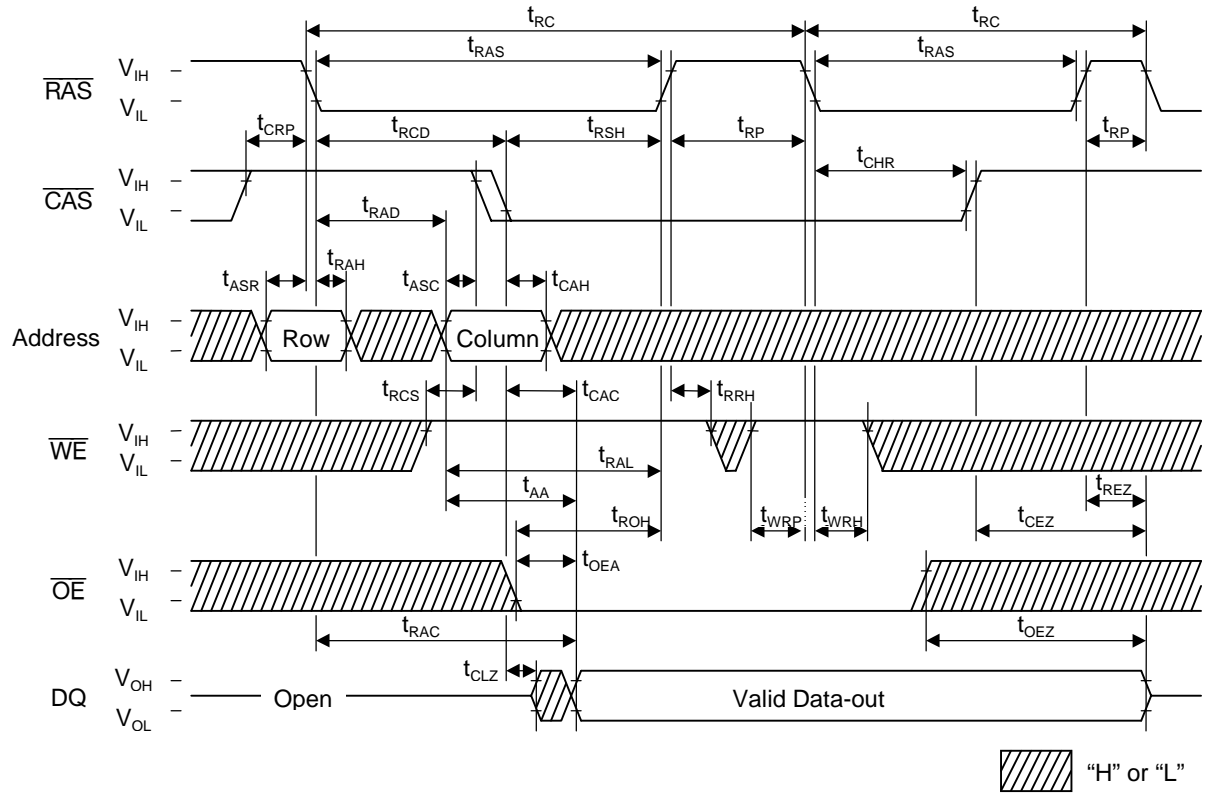
RAS-only Refresh Cycle



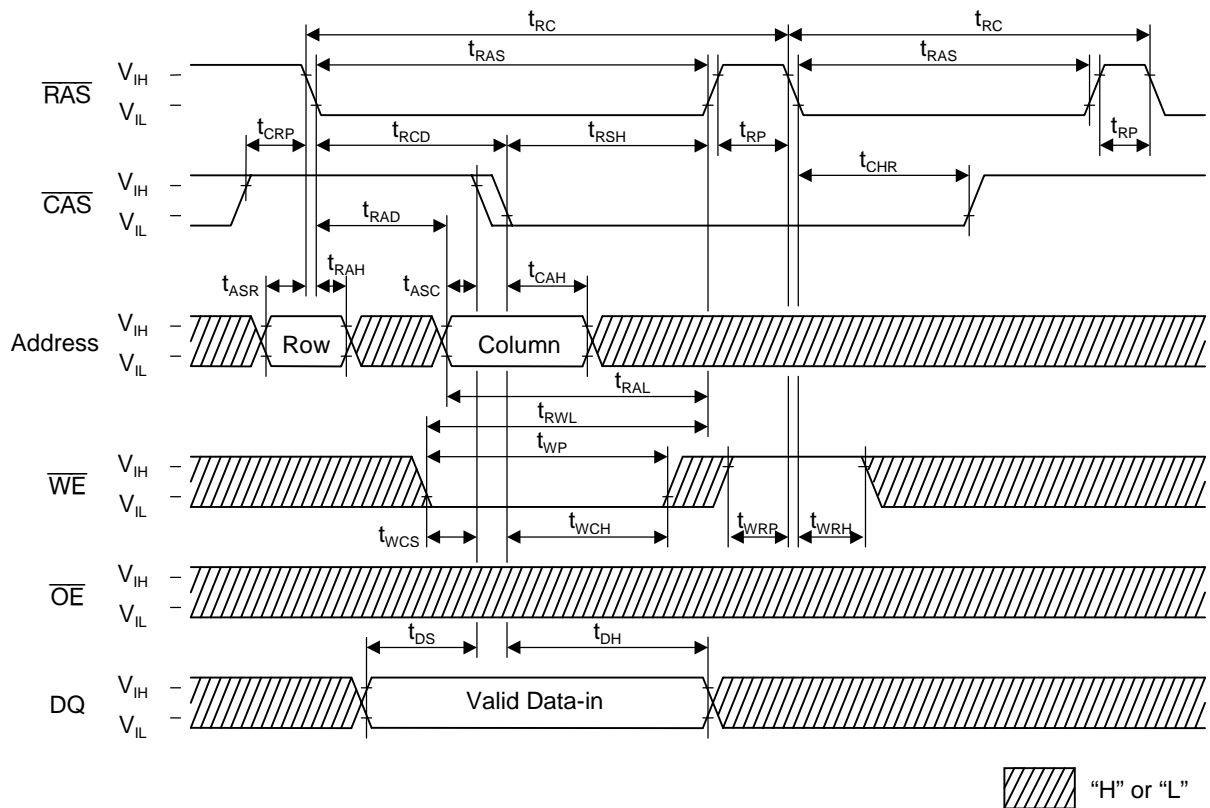
CAS before RAS Refresh Cycle



Hidden Refresh Read Cycle



Hidden Refresh Write Cycle



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