

MSM3716-AS/RS

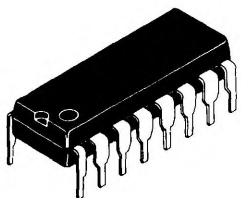
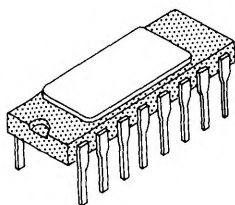
16384 WORD X 1 BIT DYNAMIC RAM

GENERAL DESCRIPTION

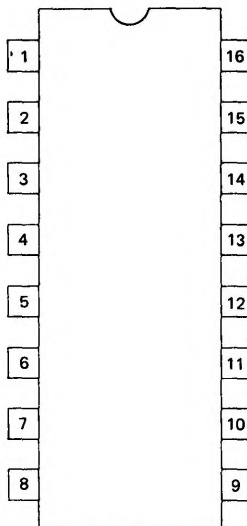
The Oki N-MOS integrated circuit MSM3716- x AS/RS is an address multiplex type dynamic RAM with a 16,384 word x 1-bit configuration, featuring a wide operational margin and high-speed low power consumption while using a single transistor.

FEATURES

- 16,384 words x 1 bit
- 150ns access time and 375ns cycle time (MSM3716-2AS/RS)
- 200ns access time and 375ns cycle time (MSM3716-3AS/RS)
- Standard 16-pin layout
- Low power consumption: 528mW (operation), 20mW (standby)
- Output data controlled by $\overline{\text{CAS}}$ only, while system design freedom is increased by not latch at cycle end.
- Read modify write, $\overline{\text{RAS}}$ only refresh and page mode operations possible.
- TTL compatible low capacitance for all inputs.
- 128 refresh cycle.



PIN CONFIGURATION



1	V _{BB}	9	V _{CC}
2	D _{IN}	10	A ₅
3	$\overline{\text{WRITE}}$	11	A ₄
4	$\overline{\text{RAS}}$	12	A ₃
5	A ₀	13	A ₆
6	A ₂	14	D _{OUT}
7	A ₁	25	$\overline{\text{CAS}}$
8	V _{DD}	16	V _{SS}

ELECTRICAL CHARACTERISTICS
ABSOLUTE MAXIMUM RATINGS
(Ta = 25°C)

Item	Symbol	Conditions	Rating	Unit
Power supply voltage	V _{DD}	Respect to V _{SS}	-1.0 ~ +15.0	V
	V _{CC}		-1.0 ~ +15.0	
	V _{BB}	Respect to V _{SS} V _{DD} - V _{SS} > 0.0	0 ~ -20.0	
	V _{DD}	Respect to V _{BB}	-0.5 ~ +20.0	
	V _{CC}		-0.5 ~ +20.0	
	V _{SS}		-0.5 ~ +20.0	
Input voltage	V _I	Respect to V _{BB}	-0.5 ~ +20.0	V
Output voltage	V _O		-0.5 ~ +20.0	
Storage temperature	T _{stg}		-55 ~ +150	°C
Permissible loss	P _D		1	W

RECOMMENDED DC OPERATING CONDITIONS

Item	Symbol	Conditions	Recommended Operating Conditions			Unit
			Min.	Typ.	Max.	
Power supply voltage	V _{DD}	V _{SS} = 0	10.8	12.0	13.2	V
	V _{CC}		4.5	5.0	5.5	
	V _{BB}		-4.5	-5.0	-5.5	
"H" clock input voltage (note 1)	V _{IHC}		2.7		6.0	
"H" input voltage (note 2)	V _{IH}		2.4		6.0	
"L" input voltage (note 3)	V _{IL}		-1.0		0.8	
Operating temperature	T _{opr}		0		70	°C

- Notes: 1. RAS, CAS and WRITE inputs
2. A₀ ~ A₈ and D_{IN} inputs
3. All inputs

DC CHARACTERISTICS

(V_{DD} = 12.0V±10%, V_{CC} = 5.0V±10%, V_{BB} = -5.0V±10%, V_{SS} = 0V, Ta = 0~70°C)

Item	Symbol	Conditions	Special Ratings		Unit	Note
			Min.	Max.		
Average power supply current during operation	I _{DD1}	t _{RC} = 375 ns		40	mA	4
	I _{CC1}					5
	I _{BB1}			200	μA	
Power supply current during standby mode	I _{DD2}	RAS = V _{IHC} D _{OUT} = High Impedance		1.5	mA	
	I _{CC2}		-10	10	μA	
	I _{BB2}			100	μA	
Refresh power supply current	I _{DD3}	t _{RC} = 375 ns		27	mA	4
	I _{CC3}		-10	10	μA	
	I _{BB3}			200	μA	
Page mode power supply current	I _{DD4}	RAS = V _{IL} t _{PC} = 225 ns		29	mA	4
	I _{CC4}					5
	I _{BB4}			200	μA	
Input leak current	I _{L1}	V _{BB} = -5V 0 ≤ V _I < 6.0V	-10	10	μA	
Output leak current	I _{L0}	D _{OUT} = Disable 0 ≤ V _O ≤ 5.5V	-10	10	μA	
"H" output voltage	V _{OH}	I _O = -5 mA	2.4		V	
"L" output voltage	V _{OL}	I _O = 4.2 mA		0.4	V	

- Notes:** 4. I_{DD1}, I_{DD3} and I_{DD4} depend on cycle time.
 5. I_{CC1} and I_{CC4} are changed by output load. V_{CC} is connected to D_{OUT} at low impedance during reading of "H" level data.

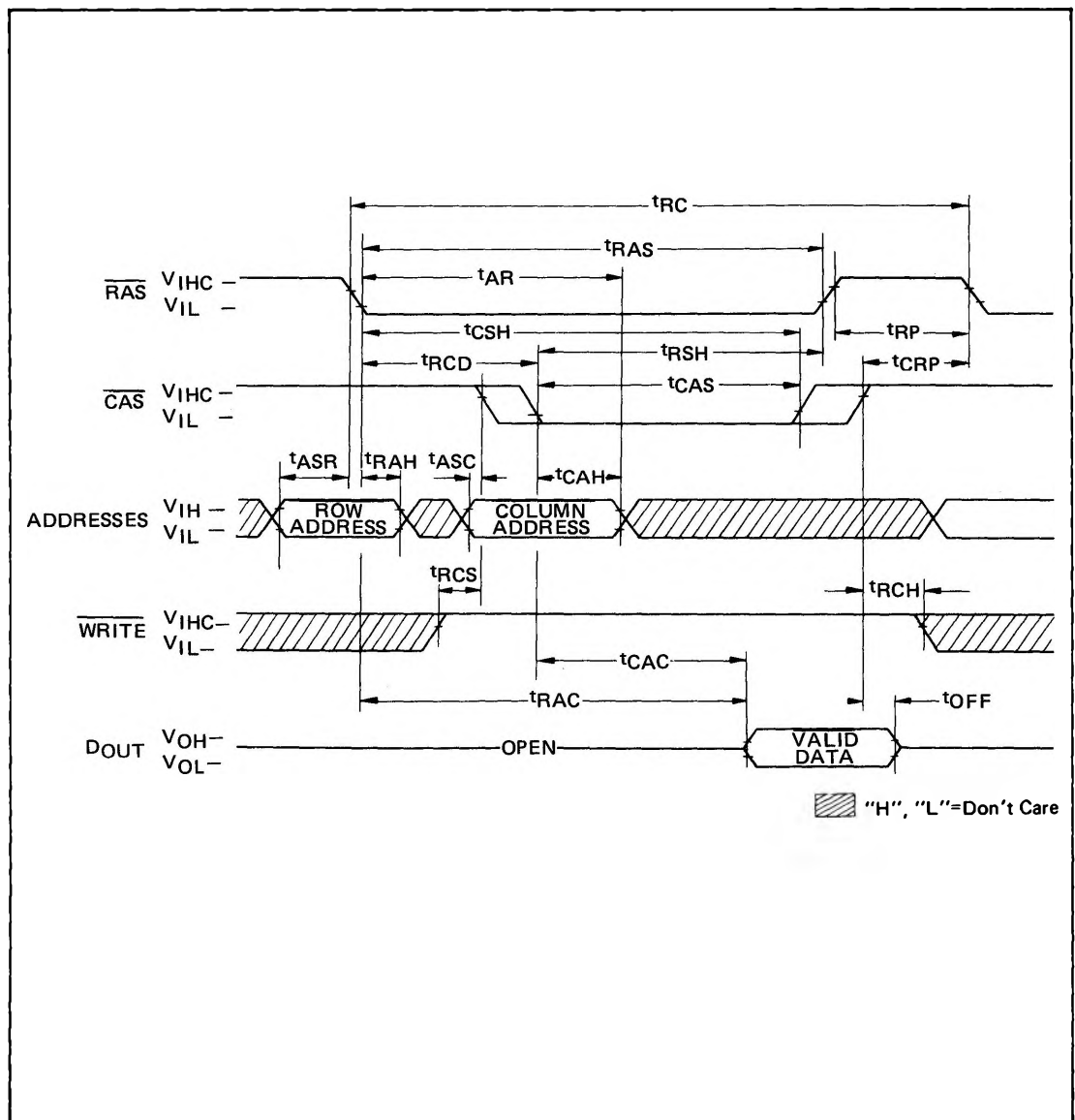
AC CHARACTERISTICS AND RECOMMENDED OPERATING CONDITIONS

($V_{DD} = 12.0V \pm 10\%$, $V_{CC} = 5.0V \pm 10\%$, $V_{BB} = -5V \pm 10\%$, $V_{SS} = 0V$, $T_a = 0 \sim 70^\circ C$) (Notes; 6, 7, 8)

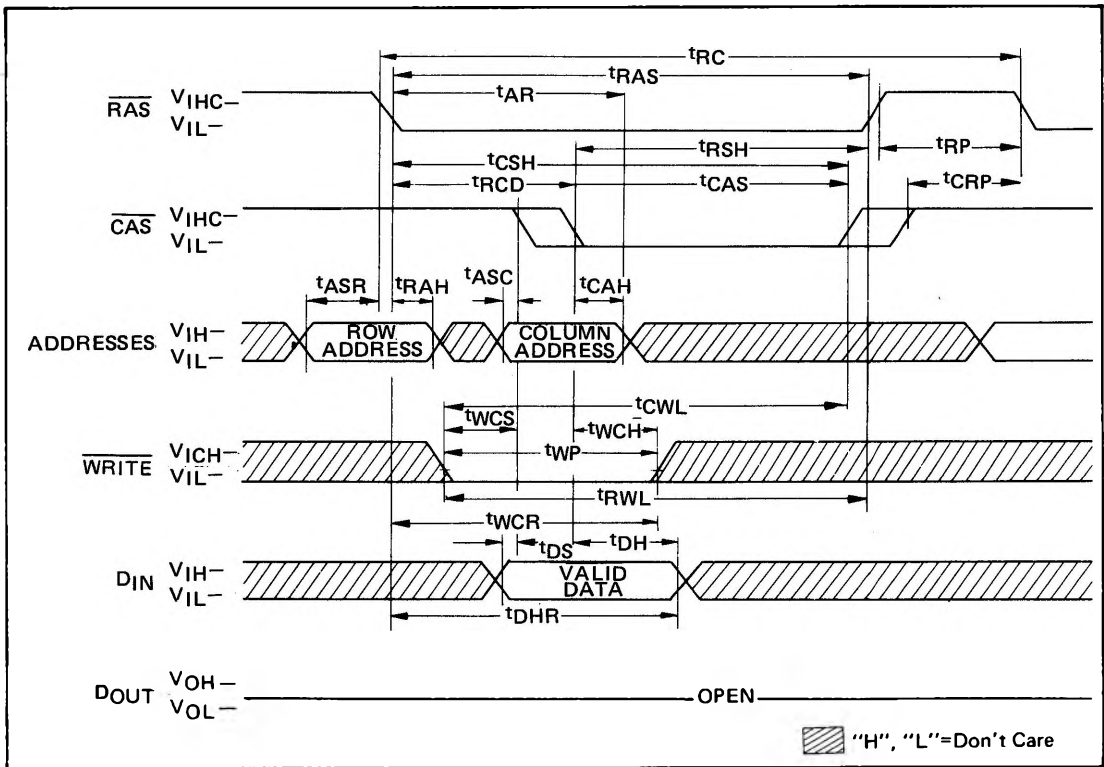
Parameter	Symbol	MSM3716-2AS/RS		MSM3716-3AS/RS		Units	Note
		Min.	Max.	Min.	Max.		
Random read/write cycle time	t_{RC}	375		375		ns	
Read and write cycle time	t_{RWC}	375		375		ns	
Page mode cycle time	t_{PC}	170		225			
Access time from $\overline{RAS}$	t_{RAC}		150		200		9, 11
Access time from $\overline{CAS}$	t_{CAC}		100		135	ns	10, 11
Output turn-off delay time	t_{OFF}	0	40	0	50	ns	
Rise and fall time	t_T	3	35	3	50	ns	
$\overline{RAS}$ precharge time	t_{RP}	100		120		ns	
$\overline{RAS}$ pulse width	t_{RAS}	150	10,000	200	10,000	ns	
$\overline{RAS}$ hold time	t_{RSH}	100		135		ns	
$\overline{CAS}$ pulse width	t_{CAS}	100	10,000	135	10,000	ns	
$\overline{CAS}$ hold time	t_{CSH}	150		200		ns	
$\overline{RAS}$ and $\overline{CAS}$ delay time	t_{RCD}	25	50	30	65	ns	12
$\overline{RAS}$ and $\overline{CAS}$ precharge time	t_{CRP}	-20		-20		ns	
Row address set-up time	t_{ASR}	0		0		ns	
Row address hold time	t_{RAH}	20		25		ns	
Column address set-up time	t_{ASC}	-5		-5		ns	
Column address hold time	t_{CAH}	45		55		ns	
Column address hold time from $\overline{RAS}$	t_{AR}	95		120		ns	
Read command set-up time	t_{RCS}	0		0		ns	
Read command hold time	t_{RCH}	0		0		ns	
Write command hold time	t_{WCH}	45		55		ns	
Write command hold time from $\overline{RAS}$	t_{WCR}	95		120		ns	
Write command pulse width	t_{WP}	45		55		ns	
Write command and $\overline{RAS}$ read time	t_{RWL}	60		80		ns	
Write command and $\overline{CAS}$ read time	t_{CWL}	60		80		ns	
Data input set-up time	t_{DS}	0		0		ns	13
Data input hold time	t_{DH}	45		55		ns	13
Input hold time for data from $\overline{RAS}$	t_{DHR}	95		120		ns	
$\overline{CAS}$ precharge time	t_{CP}	60		80		ns	
Write command set-up time	t_{WCS}	-20		-20		ns	14
$\overline{CAS}$ and write command delay time	t_{CWD}	70		95		ns	14
$\overline{RAS}$ and write command delay time	t_{RWD}	120		160		ns	14
Refresh cycle	t_{REF}		2		2	ms	

- NOTES:
- Normal memory operation may not be possible unless at least 8 cycles of operation are performed after the power is switched on.
 - AC measurements when $t_T = 5\text{ns}$.
 - Prescribed timing input levels of V_{IH} (MIN), V_{IH} (MIN) and V_{IL} (MAX).
 - In the case of $t_{RCD} \leq t_{RCD}(\text{MAX})$; t_{RAC} is increased only for $t_{RCD} - t_{RCD}(\text{MAX})$ for $t_{RCD} > t_{RCD}(\text{MAX})$ case.
 - For $t_{RCD} \geq t_{RCD}(\text{MAX})$ case.
 - For $2T_{TTL} + 100\text{pF}$ load case.
 - $t_{RCD}(\text{MAX})$ is the value guaranteed by $t_{RAC}(\text{MAX})$, and when $t_{RCD} > t_{RCD}(\text{MAX})$ it is distributed by t_{CAC} .
 - t_{DS} and t_{DH} are specified by the $\overline{\text{CAS}}$ falling edge during the write cycle (early write), and by the WRITE falling edge during read modify write cycle.
 - t_{WCS} , t_{CWD} and t_{RWD} are not parameters specifying operational limits.
 $t_{WCS} \geq t_{WCS}(\text{MIN})$ results in write cycle (early write) with high impedance output.
 $t_{CWD} \geq t_{WCS}(\text{MIN})$ and $t_{RWD} \geq t_{RWD}(\text{MIN})$ result in read modify write cycle.

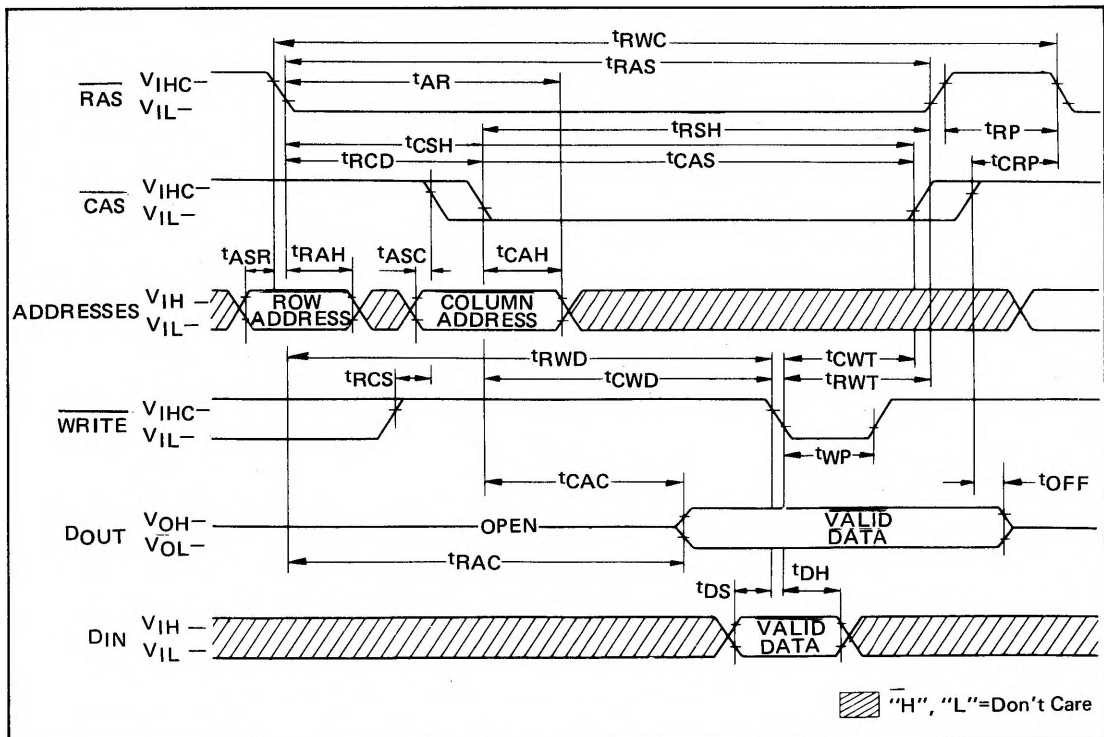
READ CYCLE



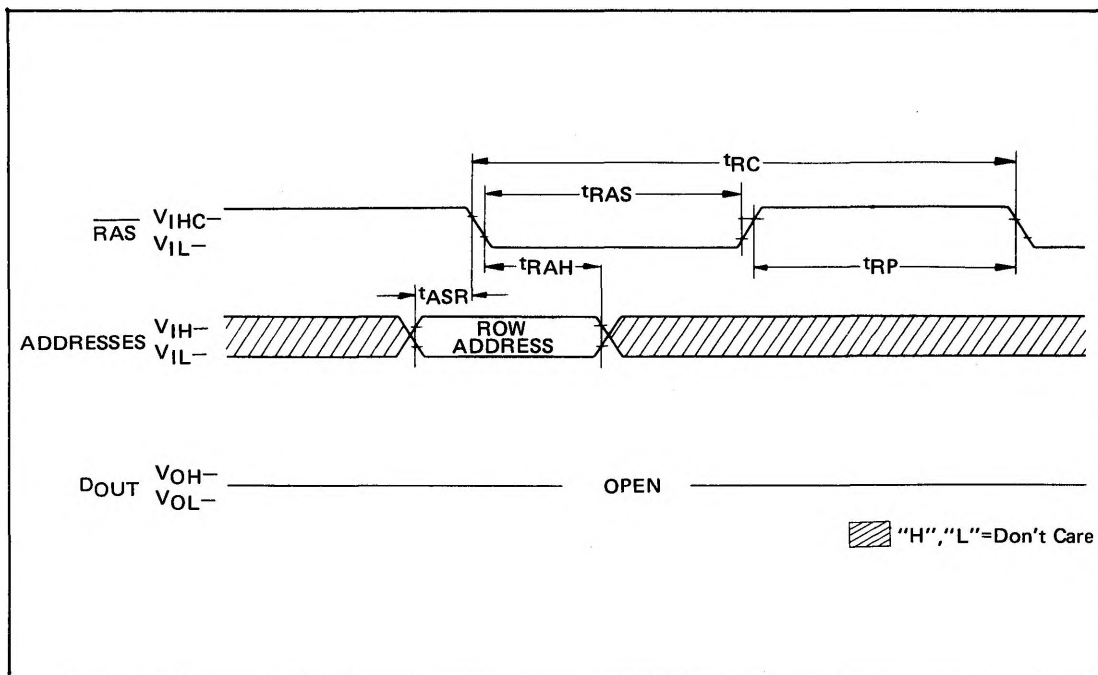
WRITE CYCLE (EARLY WRITE)



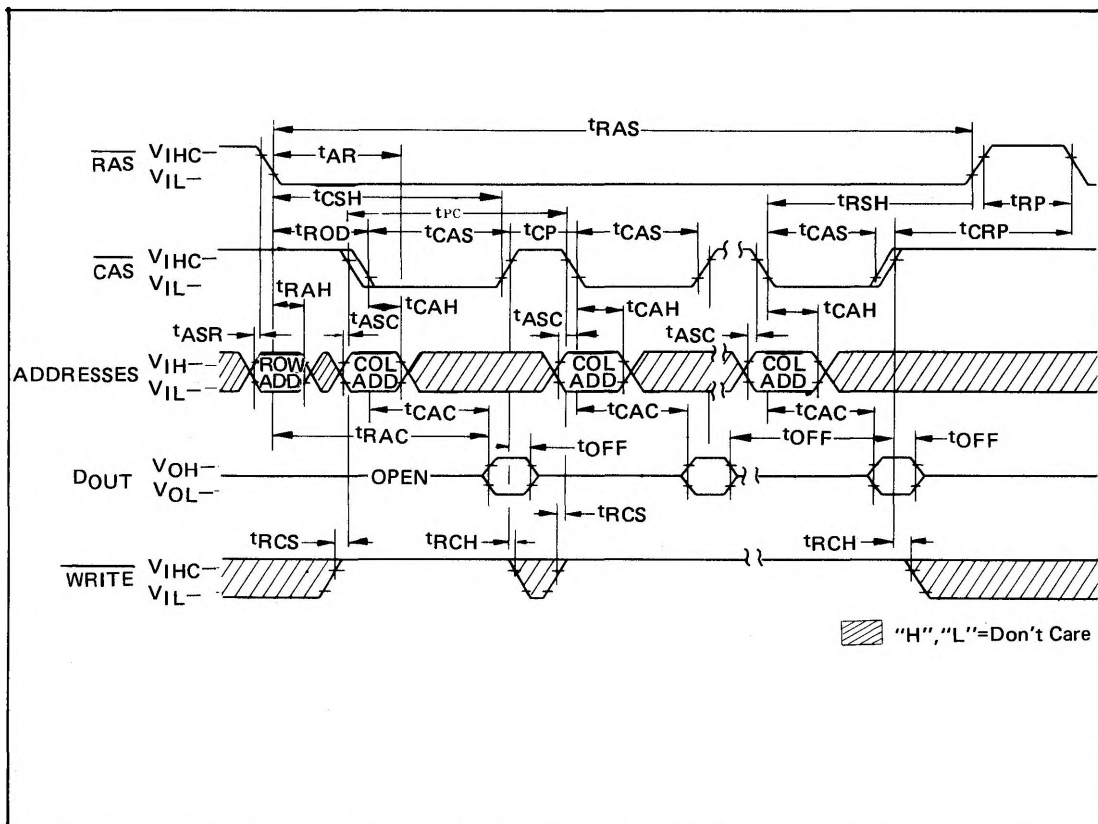
READ-WRITE/READ-MODIFY-WRITE CYCLE



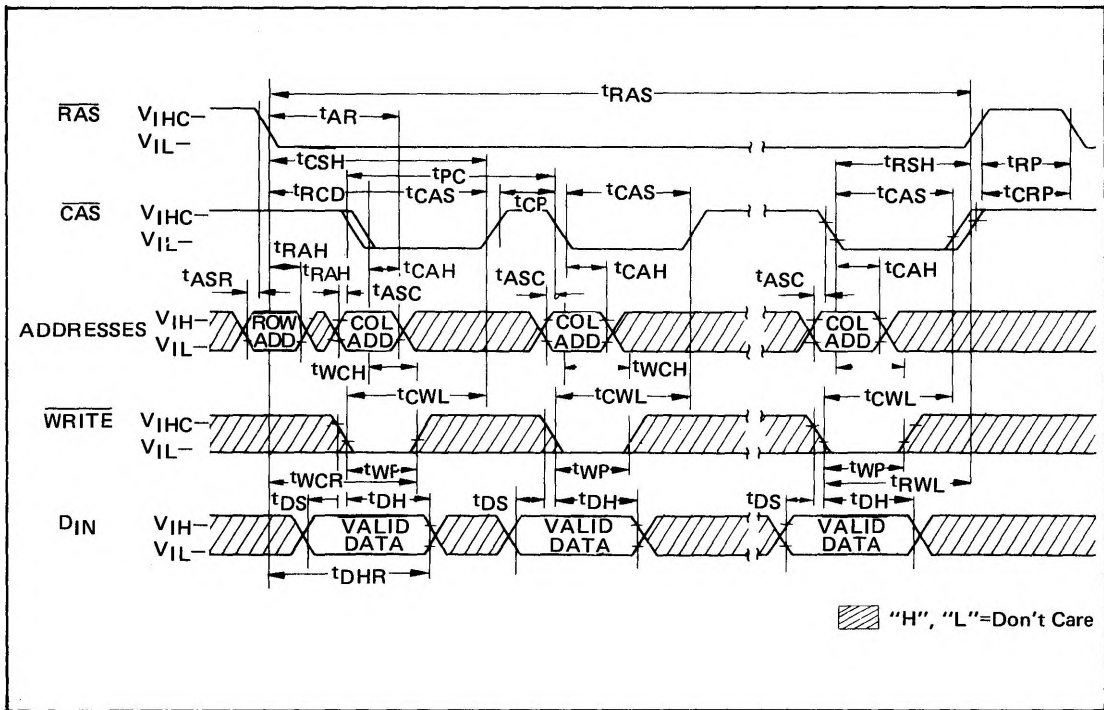
"RAS-ONLY" REFRESH CYCLE $\overline{\text{CAS}} = V_{\text{IHC}}$, $\overline{\text{WRITE}} = \text{Don't Care}$



PAGE MODE READ CYCLE



PAGE MODE WRITE CYCLE



TERMINAL CAPACITY CHARACTERISTICS

($V_{DD} = 12.0V \pm 10\%$, $V_{SS} = 0V$, $V_{BB} = 5.0V \pm 10\%$, $T_a = 0 \sim 70^\circ C$)

		Standard	Maximum	Unit	Remarks
Input capacity ($A_0 \sim A_6$, D_{IN})	C_i	4	5		
Input ($\overline{RAS}$, $\overline{CAS}$, $\overline{WRITE}$)	C_i	8	10	pF	
Output capacity (D_{OUT})	C_o	5	7		$\overline{CAS} = V_{IHC}$

TYPICAL CHARACTERISTICS

