LH6V4256

CMOS 1M (256K × 4) Dynamic RAM

FUNCTION

- 262,144 words × 4 bit
- Access time: 100 ns (MAX)
- Cycle time: 190 ns (MIN)
- Fast page mode cycle time: 60 ns (MIN)
- Power supply: +3.3 V ±0.3 V
- Power consumption (MAX):
  Operating: 126 mW
  Standby: 0.54 mW
- Built-in latch circuit for row-address, column-address, and input data
- $\overline{OE}$ = Don't care in early write operation
- $\overline{RAS}$ only refresh, hidden refresh, and $\overline{CAS}$ before $\overline{RAS}$ refresh capability
- On-chip refresh counter
- 512 refresh cycle/8 ms
- Packages:
  20-pin, 300-mil DIP
  26-pin, 300-mil SOJ
  28-pin, 8 × 13 mm^2 TSOP (Type I)

DESCRIPTION

The LH6V4256 is a 262,144 word × 4-bit dynamic RAM which allows fast page mode access. The LH6V4256 is fabricated on SHARP's advanced CMOS double-level polysilicon gate technology. With its input multiplexed and packaged in the standard 20-pin DIP, 26-pin SOJ, or 28-pin TSOP (I) packages, it is easy to realize memory systems with low power dissipation and large memory capacity. The LH6V4256 operates on a single +3.3 V power supply and the built-in biasing voltage generator circuit.

PIN CONNECTIONS

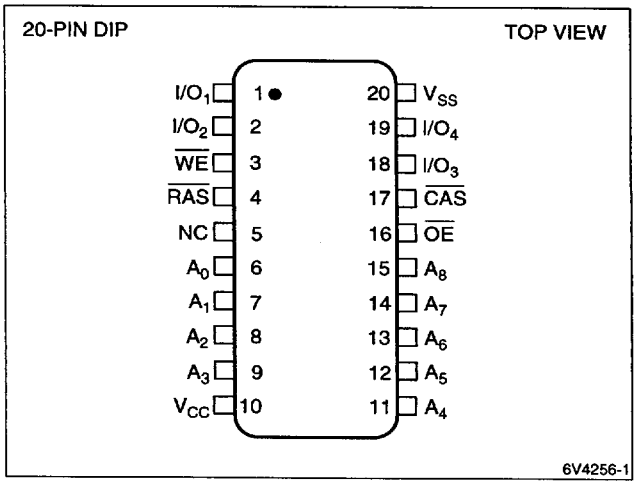


Figure 1. Pin Connections for DIP Package

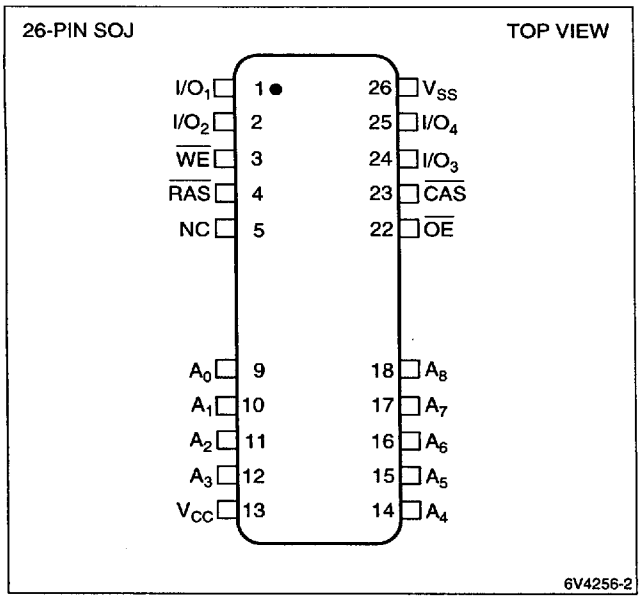


Figure 2. Pin Connections for SOJ Package

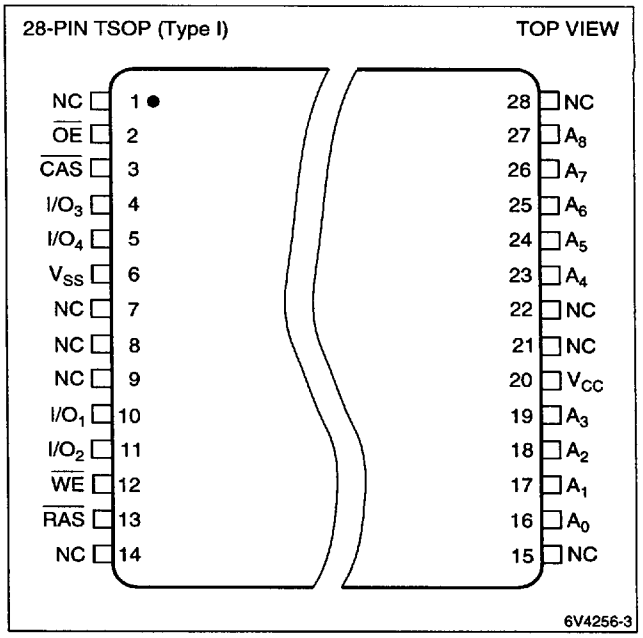


Figure 3. Pin Connections for TSOP Package

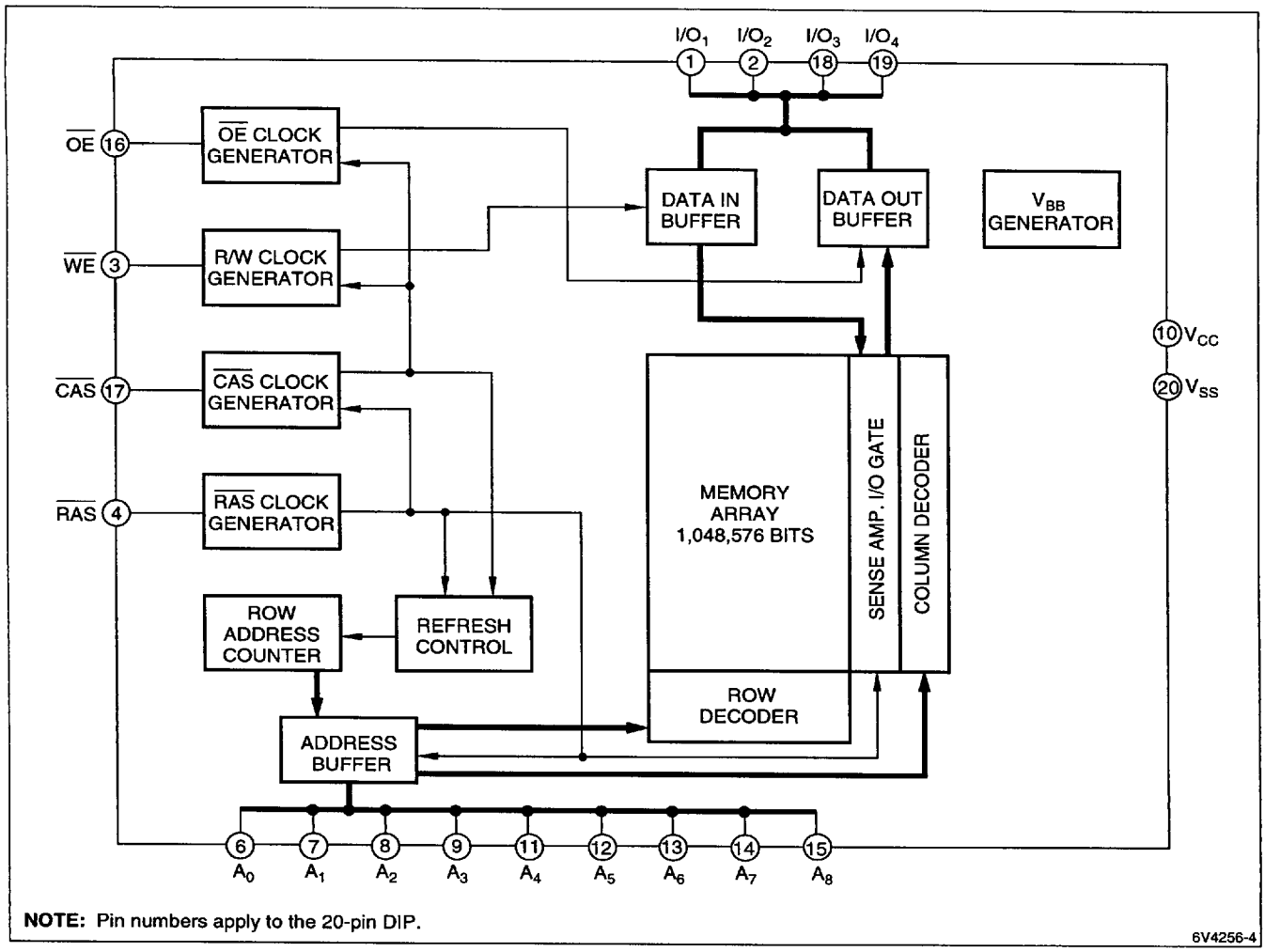


Figure 4. LH6V4256 Block Diagram

PIN DESCRIPTION

PIN NAME	FUNCTION
$A_0 - A_8$	Address input
$\overline{RAS}$	Row address strobe
$\overline{CAS}$	Column address strobe
$\overline{WE}$	Write enable
$\overline{OE}$	Output enable

PIN NAME	FUNCTION
$I/O_1 - I/O_4$	Data input/output
V_{CC}	Power supply (+3.3 V)
V_{SS}	Power supply (0 V)
NC	No connection

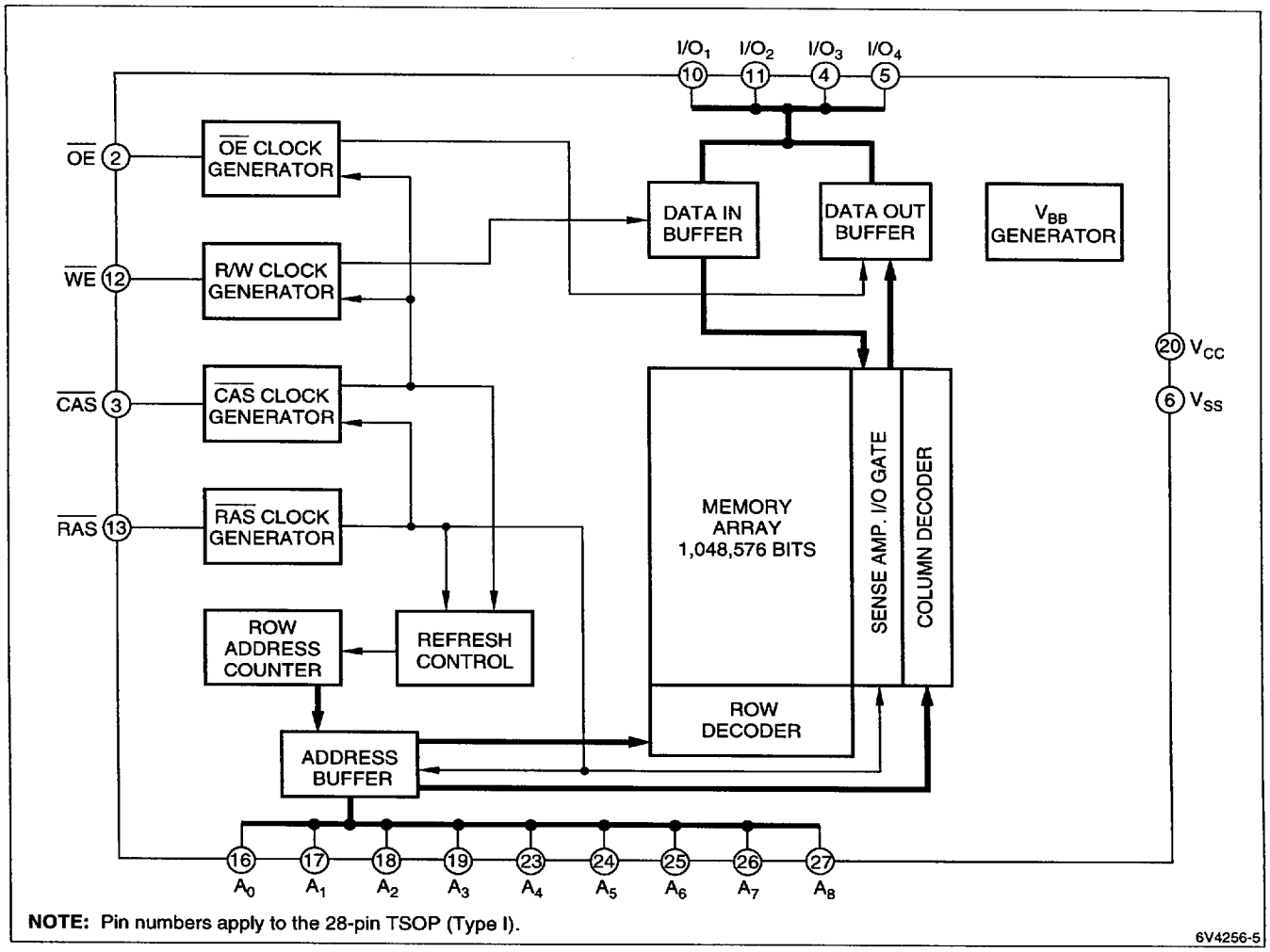


Figure 5. LH6V4256 Block Diagram

ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT	NOTE
Applied voltage on all pins	−0.5 to +5.5	V	1
Output short circuit current	50	mA	
Power dissipation	1.0	W	
Operating temperature	0 to +70	°C	
Storage temperature	−65 to +150	°C	

NOTE:
1. The maximum applicable voltage on any pin with respect to V_{SS}.

RECOMMENDED OPERATING CONDITIONS (T_A = 0 to +70°C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{CC}	3.0	3.3	3.6	V
	V_{SS}	0	0	0	V
Input voltage	V_{IH}	2.3		V_{CC} + 0.3	V
	V_{IL}	−0.3		0.6	V

CAPACITANCE (T_A = 0 to +70°C, f = 1 MHz, V_{CC} = 3.3 V ±0.3 V)

PARAMETER	CONDITIONS	SYMBOL	MIN.	MAX.	UNIT
Input capacitance	$A_0 - A_8$	C_{IN1}		6	pF
	$\overline{RAS}$, $\overline{OE}$, $\overline{CAS}$, $\overline{WE}$	C_{IN2}		7	pF
Input/output capacitance	$I/O_1 - I/O_4$	C_{OUT1}		7	pF

DC ELECTRICAL CHARACTERISTICS (T_A = 0 to +70°C, V_{CC} = 3.3 V ±0.3 V)

PARAMETER	CONDITIONS	SYMBOL	MIN.	MAX.	UNIT	NOTE
Average supply current in normal operation		I_{CC1}		35	mA	1, 2, 3
Supply current in standby mode	$\overline{RAS}$ = $\overline{CAS}$ ≥ V_{CC} − 0.2 V	I_{CC2}		0.15	mA	1
Average supply current in fast page mode		I_{CC3}		30	mA	1, 2
Average supply current in $\overline{CAS}$ before $\overline{RAS}$ refresh cycle		I_{CC4}		35	mA	1, 2, 3
Average supply current in $\overline{RAS}$ only refresh cycle		I_{CC5}		35	mA	1, 2, 3
Input leakage current	0 V ≤ V_{IN} ≤ 4.8 V 0 V except on test pins	I_{LI}	−10	10	µA	
Output leakage current	0 V ≤ V_{OUT} ≤ 4.8 V Output in high-impedance state	I_{LO}	−10	10	µA	
Output 'High' Voltage	I_{OUT} = −200 µA	V_{OH}	2.15		V	
Output 'Low' Voltage	I_{OUT} = 1 mA	V_{OL}		0.4	V	

NOTES:
1. Specified values are with outputs open.
2. I_{CC1}, I_{CC3}, I_{CC4}, and I_{CC5} depend on cycle time.
3. Cycle time is 190 ns. Address transition is once at $\overline{RAS}$ = V_{IH} and once at $\overline{RAS}$ = V_{IL}.

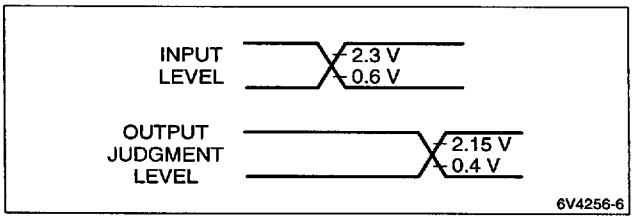
AC ELECTRICAL CHARACTERISTICS [1, 2, 3, 4] (T_A = 0 to +70°C, V_{CC} = 3.3 V ±0.3 V)

READ CYCLE

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Random read or write cycle time	t_{RC}	190		ns	
Access time from $\overline{RAS}$	t_{RAC}		100	ns	5
Access time from column address	t_{AA}		50	ns	5
Access time from $\overline{CAS}$	t_{CAC}		40	ns	5
Access time from $\overline{OE}$	t_{OEA}		35	ns	5
Row address setup time	t_{ASR}	0		ns	
Row address hold time	t_{RAH}	15		ns	
Column address setup time	t_{ASC}	0		ns	
Column address hold time ($\overline{RAS}$)	t_{CAH}	20		ns	
Column address delay time ($\overline{RAS}$)	t_{RAD}	20	50	ns	6
Column address lead time ($\overline{RAS}$)	t_{RAL}	50		ns	
$\overline{RAS}$ pulse width	t_{RAS}	100	10,000	ns	
$\overline{RAS}$ precharge time	t_{RP}	80		ns	
$\overline{CAS}$ precharge time ($\overline{RAS}$ ↓)	t_{CRP}	0		ns	
$\overline{CAS}$ delay time ($\overline{RAS}$)	t_{RCD}	25	60	ns	7
$\overline{CAS}$ lead time ($\overline{RAS}$)	t_{RSL}	30		ns	
$\overline{CAS}$ pulse width	t_{CAS}	40	10,000	ns	
$\overline{CAS}$ hold time	t_{CSH}	100		ns	
$\overline{OE}$ lead time ($\overline{RAS}$)	t_{ROL}	0		ns	
Output data disable time ($\overline{CAS}$)	t_{OFF}		30	ns	
Output data disable time ($\overline{OE}$)	t_{OEZ}		30	ns	
Output data hold time ($\overline{CAS}$)	t_{SOH}	0		ns	
Output data hold time ($\overline{OE}$)	t_{OOH}	0		ns	
Read command setup time ($\overline{CAS}$)	t_{RCS}	0		ns	
Read command hold time ($\overline{CAS}$)	t_{RCH}	10		ns	8
Read command hold time ($\overline{RAS}$ ↑)	t_{RRHP}	10		ns	8
Read command hold time ($\overline{RAS}$ ↓)	t_{RRHN}	115		ns	8
Transition time (rise and fall)	t_T	3	35	ns	
Refresh time interval	t_{REF}		8	ms	

NOTES:

1. For proper memory function, at least 200 µs of pause time should be kept after power on, followed by several dummy cycles. When $\overline{RAS}$ = V_{IH} is continued for more than 8 ms, the same dummy cycles should be given. Usually eight ordinary refresh cycles should be given.
2. The required V_{CC} current (I_{CC}) during power on depends on the input levels of $\overline{RAS}$. If $\overline{RAS}$ = V_{IL} during power on, the device goes into an active cycle, and I_{CC} exhibits large current transients. It is recommended that $\overline{RAS}$ tracks with V_{CC} or be held at a valid V_{IH} during power on.
3. AC characteristics assume t_T = 5 ns.
4. AC characteristics assume the following condition (see figure at right).
5. Load condition for 1TTL + 30 pF.
6. t_{RAD} (MAX) is the maximum point for t_{RAD} where t_{RAC} (MAX) is ensured, and does not represent a limit of operation. If $t_{RAD} \geq t_{RAD}$ (MAX), the access time comes under the control of t_{AA}.
7. t_{RCD} (MAX) is the maximum point for t_{RCD}, where t_{RAC} (MAX) is ensured and does not represent a limit of operation. If $t_{RCD} \geq t_{RCD}$ (MAX), the access time comes under the control of t_{CAC}.
8. The operation is ensured when either t_{RRHN}, t_{RRHP}, or t_{RCH} is satisfied.



FAST PAGE MODE CYCLE

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Fast page mode cycle time	t_{PC}	60		ns	
$\overline{CAS}$ precharge time	t_{CP}	10		ns	
$\overline{CAS}$ precharge access time	t_{CACP}		55	ns	
Read-write cycle time (page mode)	t_{PRWC}	125		ns	1

NOTE:

1. t_{RWC}, t_{RWD}, t_{AWD}, t_{CWD}, and t_{PRWC} are not restrictive operating parameters and does not represent a limit of operation.

WRITE CYCLE

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
EARLY WRITE					
Write command setup time ($\overline{CAS}$)	t_{WCS}	0		ns	1
Write command hold time ($\overline{CAS}$)	t_{WCH}	15		ns	
Data input setup time	t_{DS}	0		ns	
Data input hold time	t_{DH}	20		ns	
$\overline{OE}$ CONTROLLED					
$\overline{CAS}$ setup time	t_{CWS}	0		ns	1
Write command lead time ($\overline{RAS}$)	t_{RWL}	30		ns	
Write command lead time ($\overline{CAS}$)	t_{CWL}	25		ns	
Write pulse width ($\overline{WE}$)	t_{WP}	15		ns	
$\overline{OE}$ hold time ($\overline{WE}$)	t_{OEH}	20		ns	

NOTE:

1. t_{WCS} and t_{CWS} are not restrictive operating parameters. If $t_{WCS} \geq t_{WCS}$ (MIN), the cycle is an early write cycle and data out buffers remain inactive until $\overline{CAS}$ rises again.

READ-WRITE CYCLE/READ-MODIFY-WRITE CYCLE

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTE
Read-write cycle time	t_{RWC}	260		ns	1
$\overline{WE}$ delay time ($\overline{RAS}$)	t_{RWD}	135		ns	1
Column address delay time ($\overline{WE}$)	t_{AWD}	85		ns	1
$\overline{WE}$ delay time ($\overline{CAS}$)	t_{CWD}	65		ns	1
$\overline{OE}$ delay time	t_{OED}	25		ns	

NOTE:

1. t_{RWC}, t_{RWD}, t_{AWD}, t_{CWD}, and t_{PRWC} are not restrictive operating parameters and does not represent a limit of operation.

$\overline{CAS}$ BEFORE $\overline{RAS}$ REFRESH CYCLE/HIDDEN REFRESH CYCLE

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
$\overline{CAS}$ setup time ($\overline{RAS}$)	t_{CSR}	0		ns
$\overline{CAS}$ hold time ($\overline{RAS}$)	t_{CHR}	20		ns
$\overline{RAS}$ • $\overline{CAS}$ precharge time ($\overline{RAS}$ ↑)	t_{RPCP}	10		ns
$\overline{RAS}$ • $\overline{CAS}$ precharge time ($\overline{RAS}$ ↓)	t_{RPCN}	115		ns
$\overline{WE}$ precharge time ($\overline{RAS}$)	t_{WRP}	0		ns

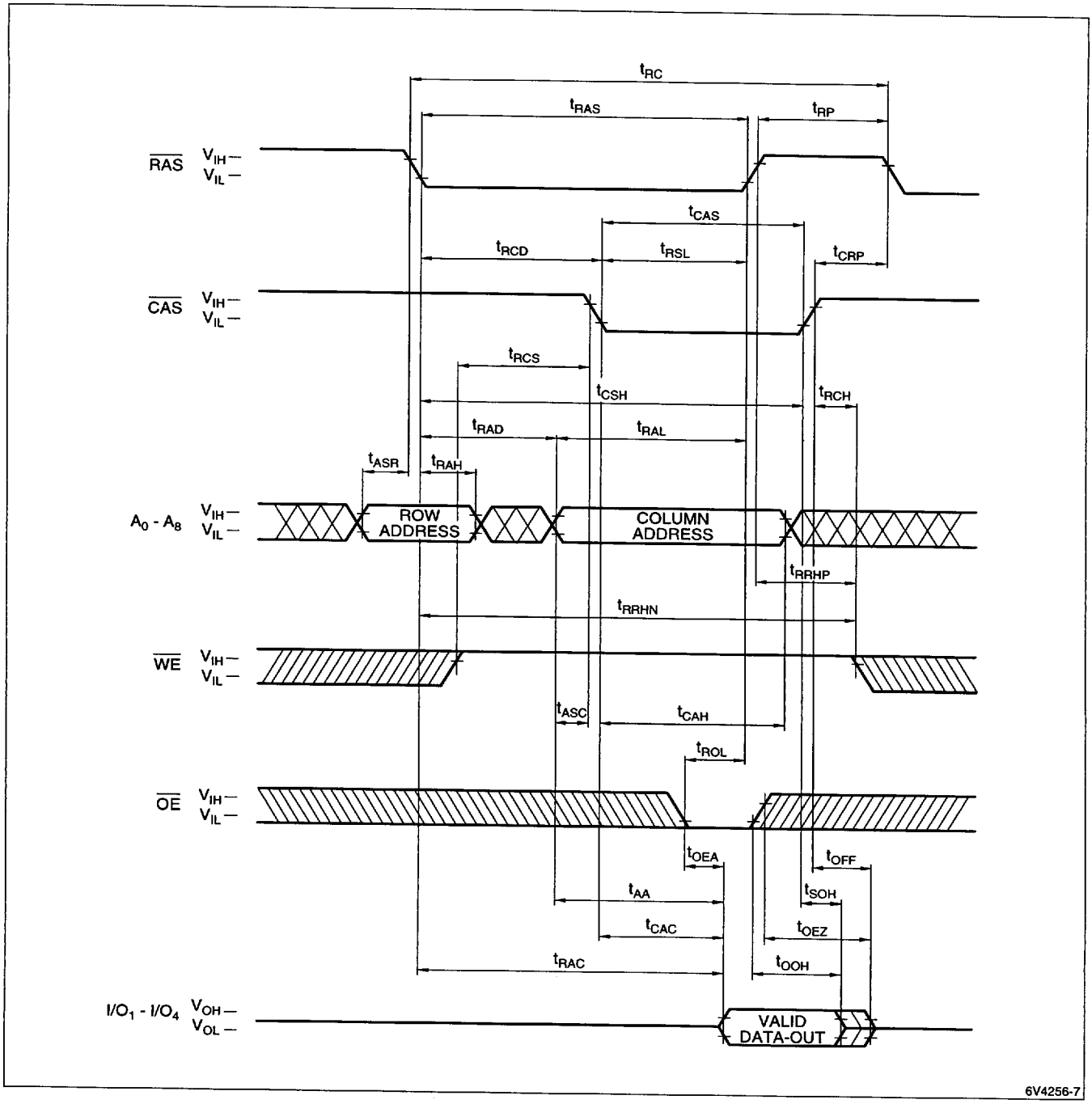


Figure 6. Read Cycle

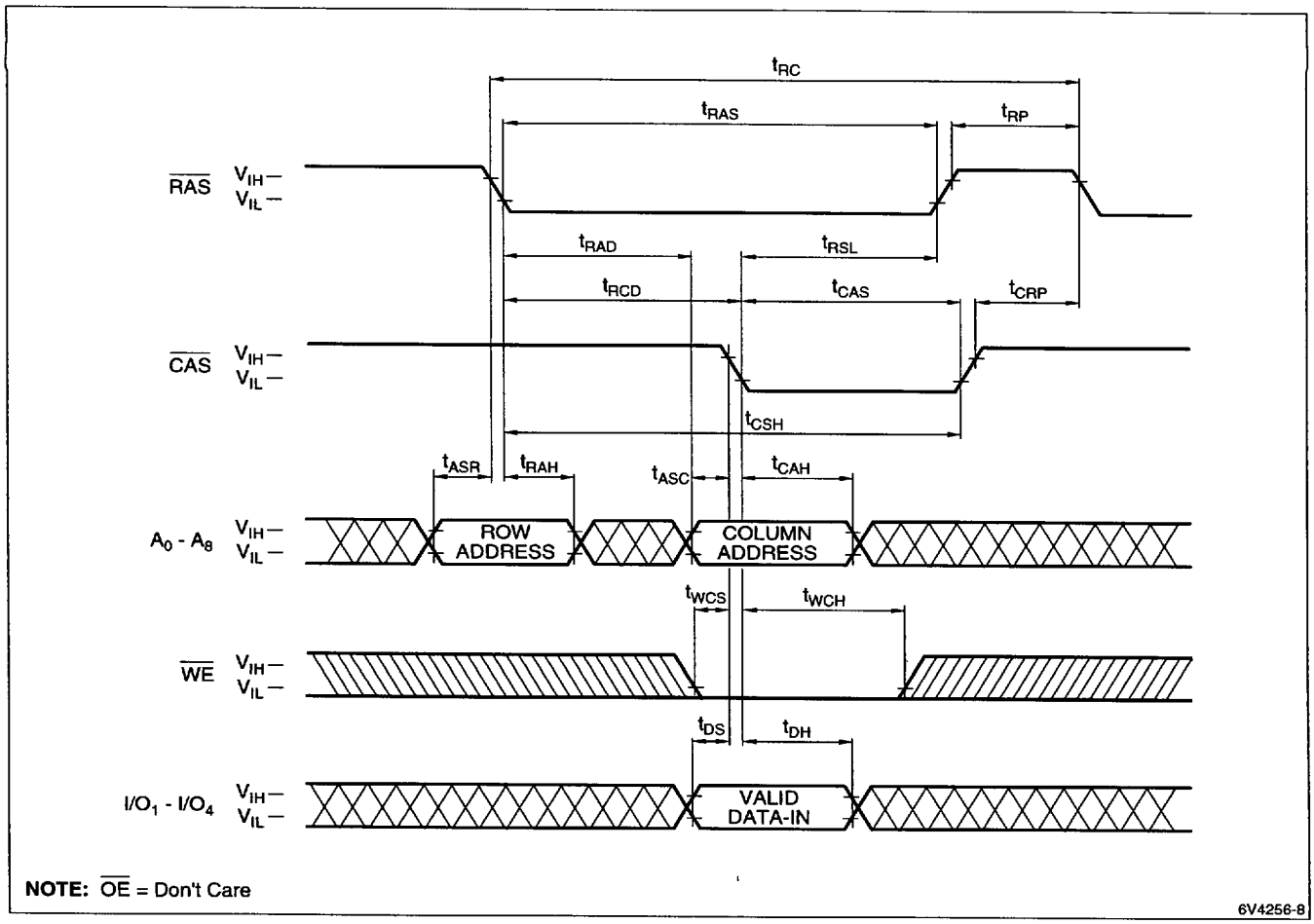


Figure 7. Write Cycle (Early Write)

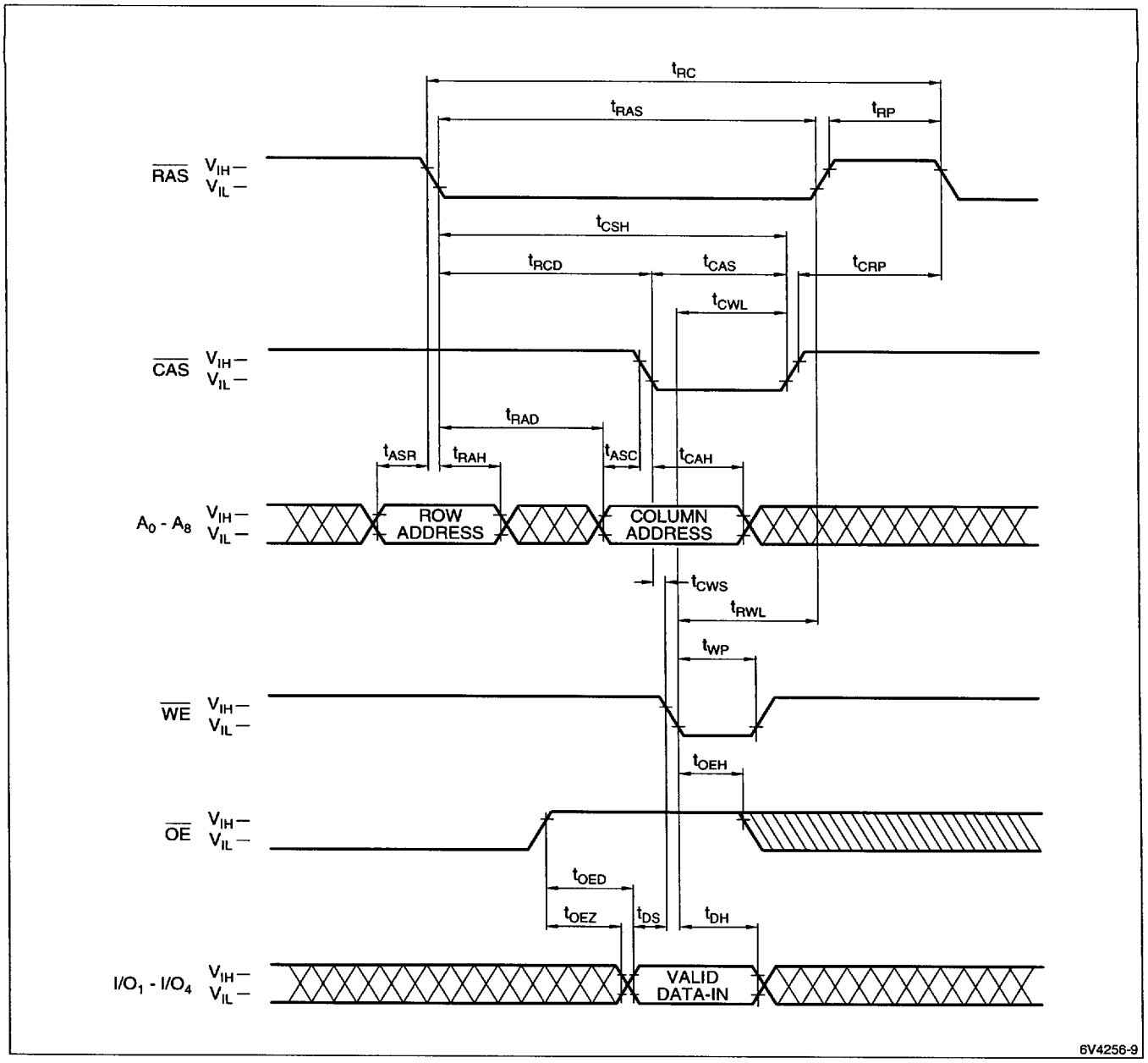


Figure 8. Write Cycle ($\overline{OE}$ Controlled Write)

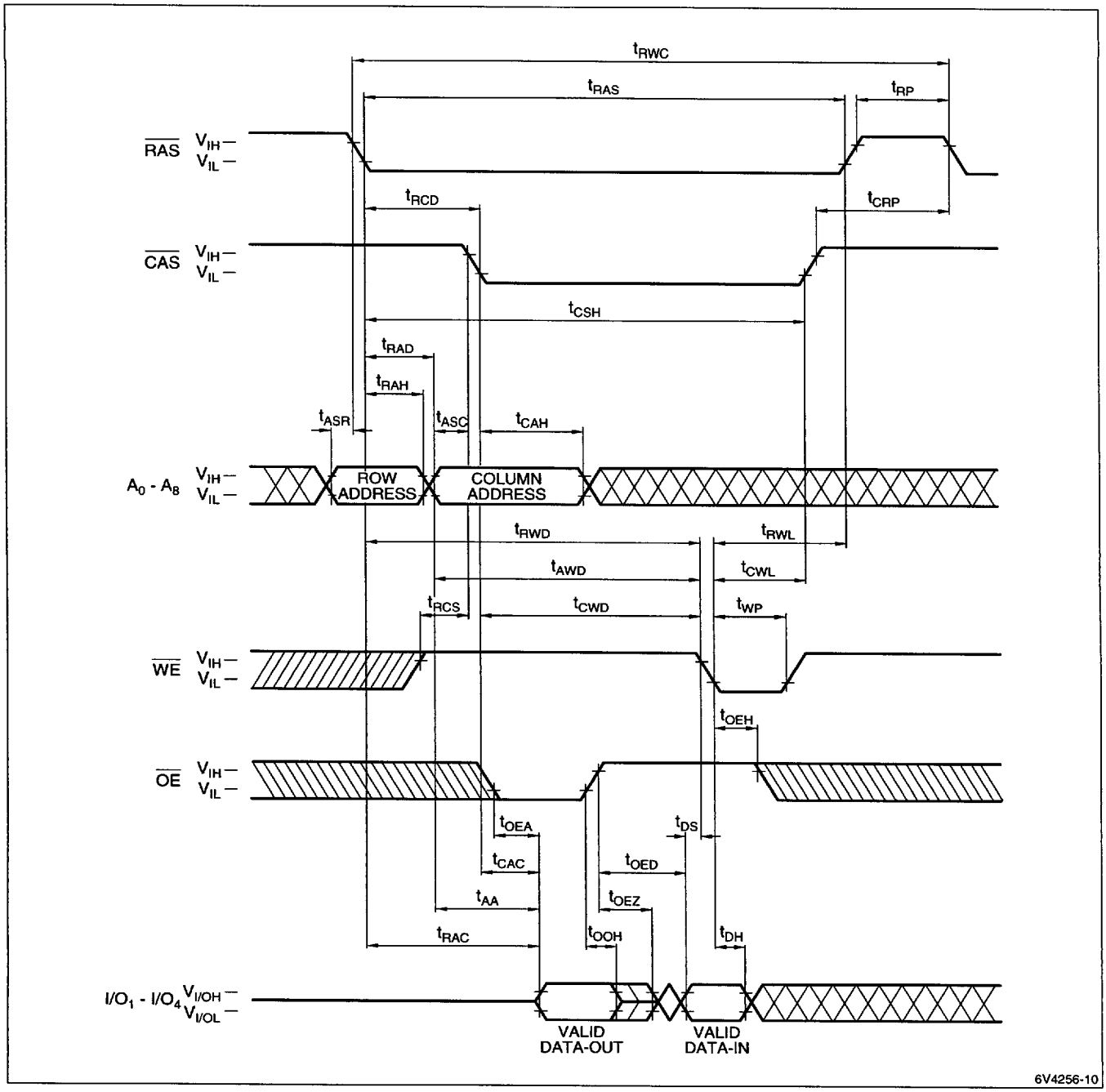


Figure 9. Read/Write Cycle

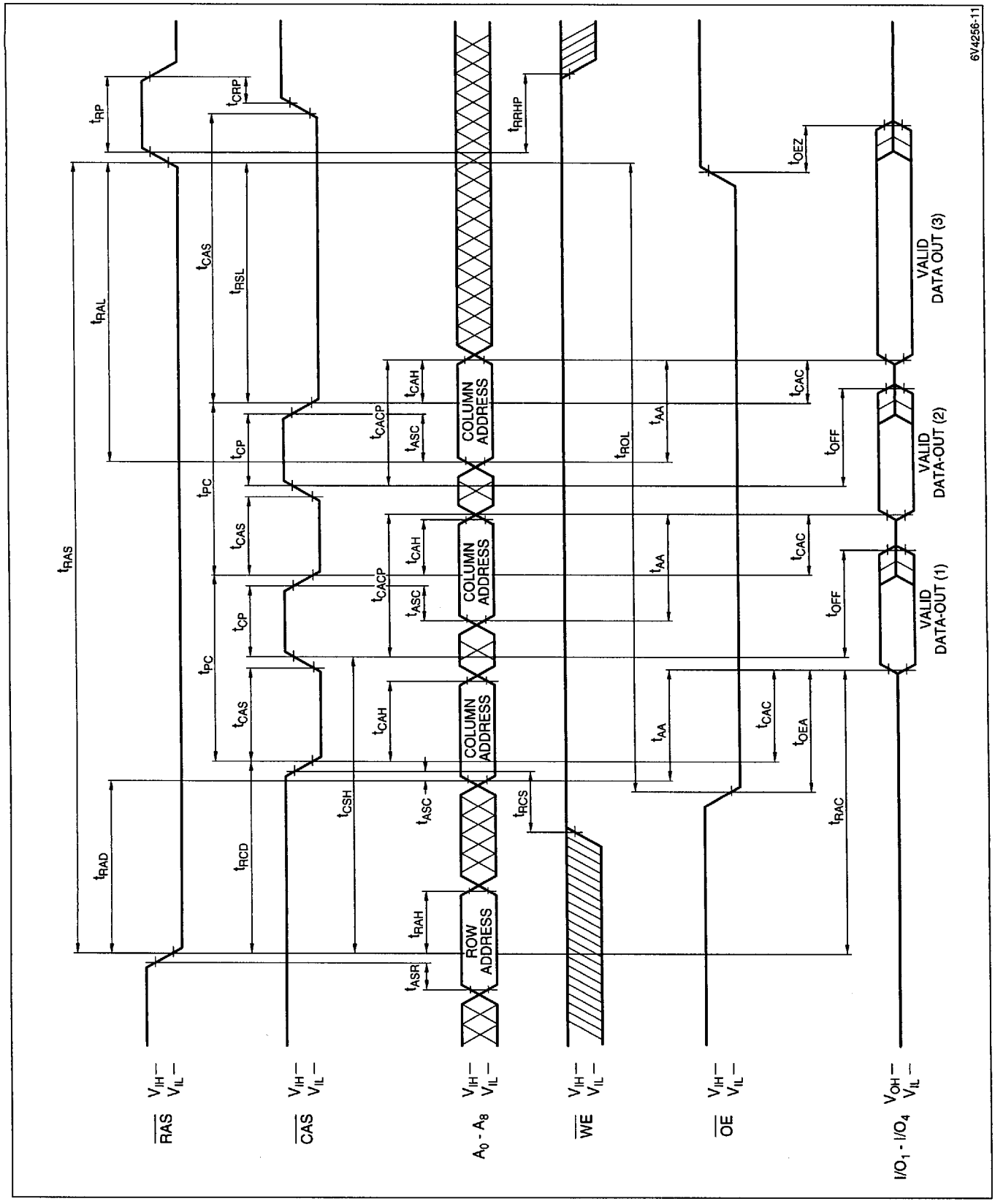


Figure 10. Fast Page Mode Read Cycle

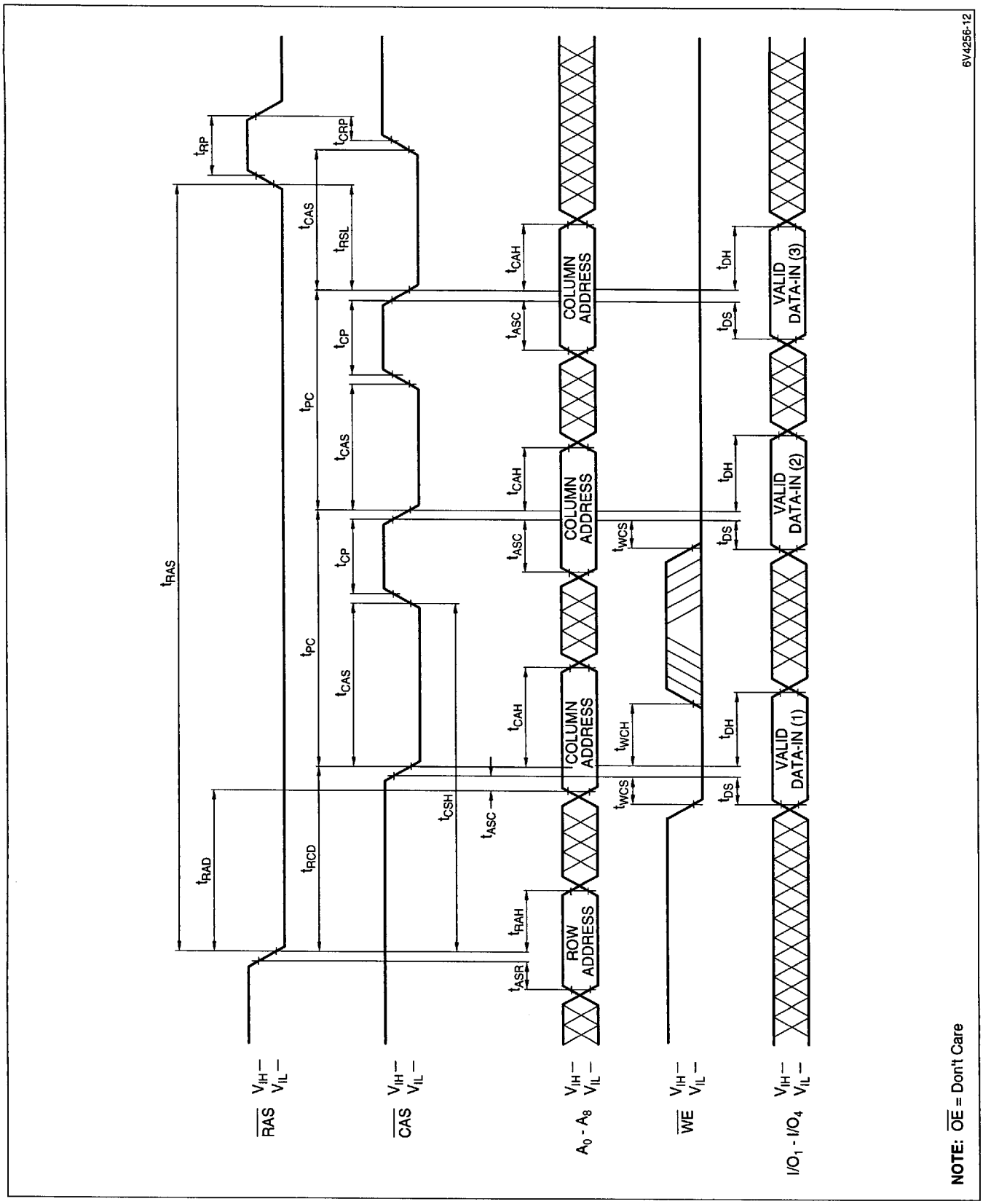


Figure 11. Fast Page Mode Write Cycle

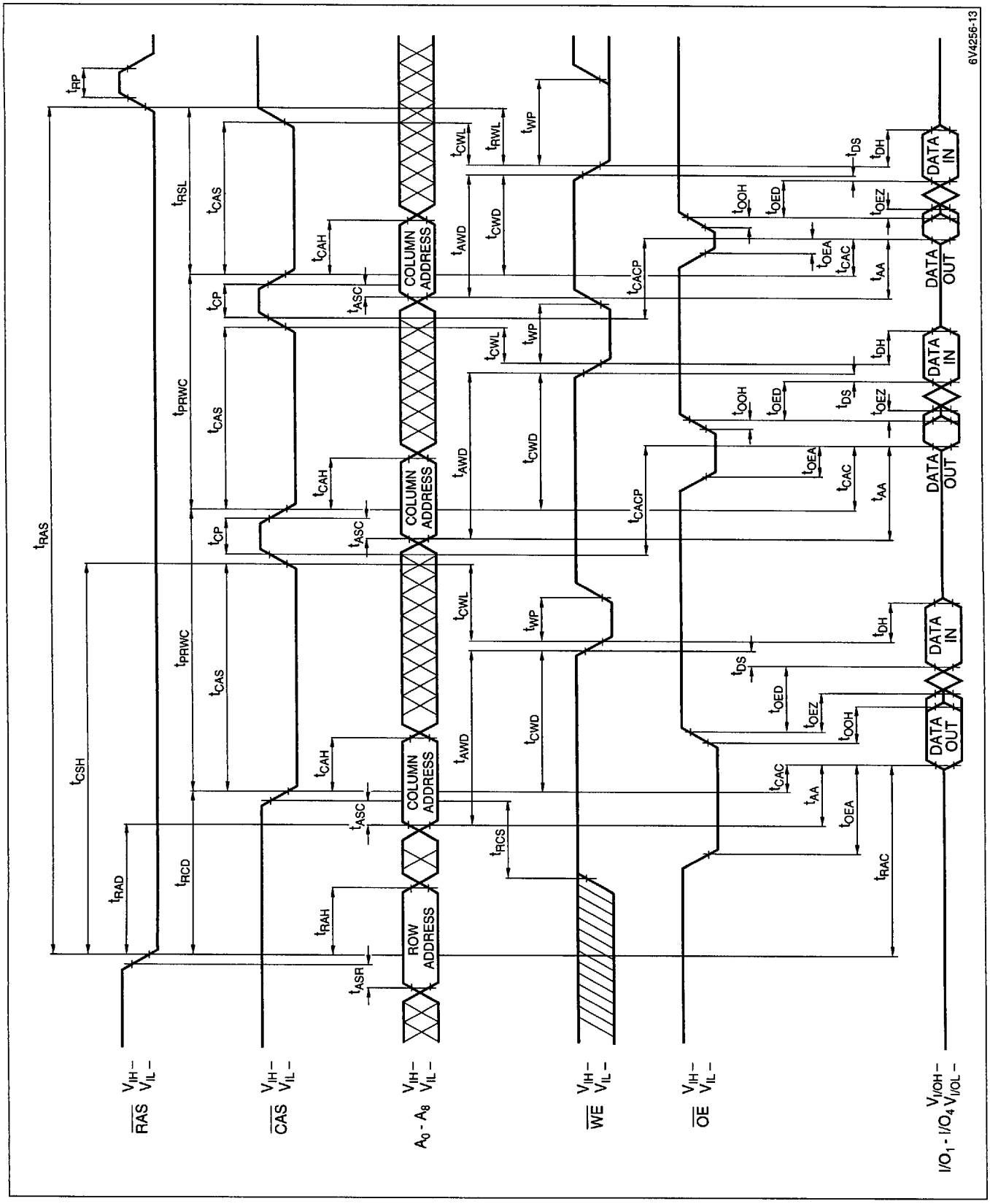


Figure 12. Fast Page Mode Read/Write Cycle

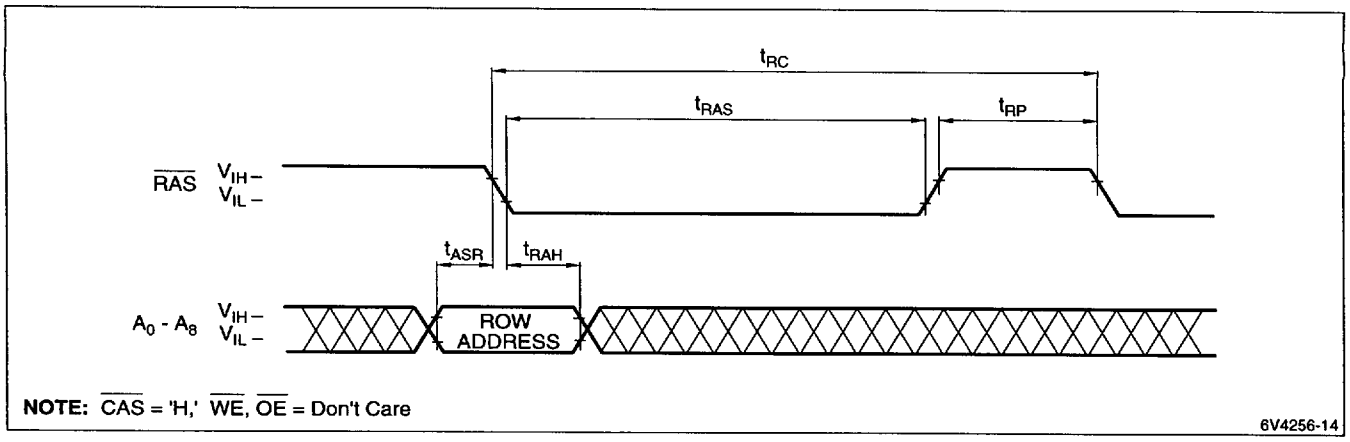


Figure 13. $\overline{RAS}$ Only Refresh Cycle

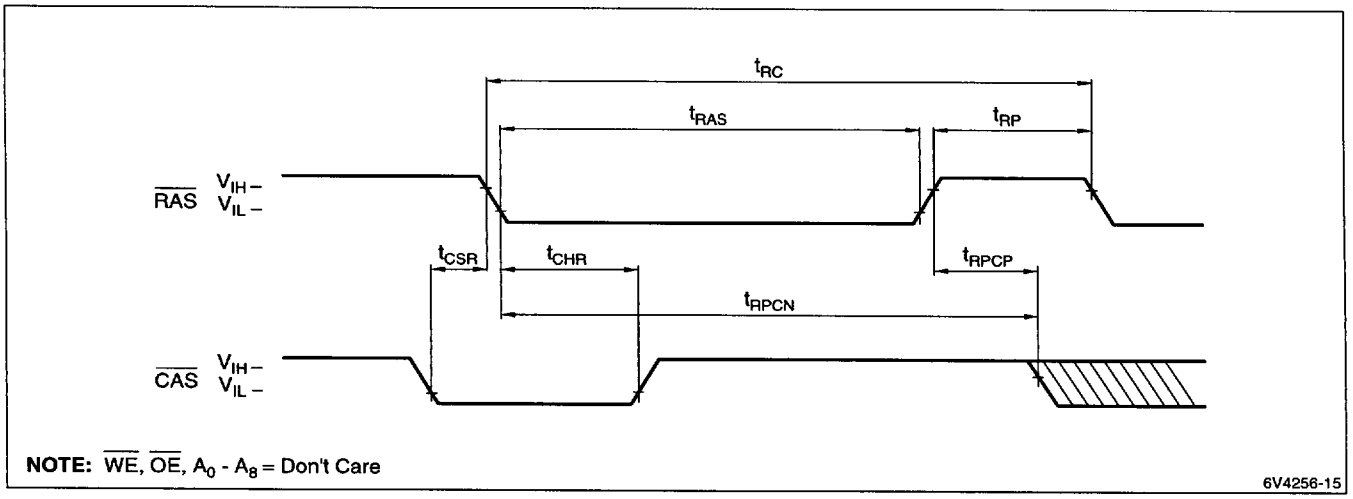


Figure 14. $\overline{CAS}$ Before $\overline{RAS}$ Refresh Cycle

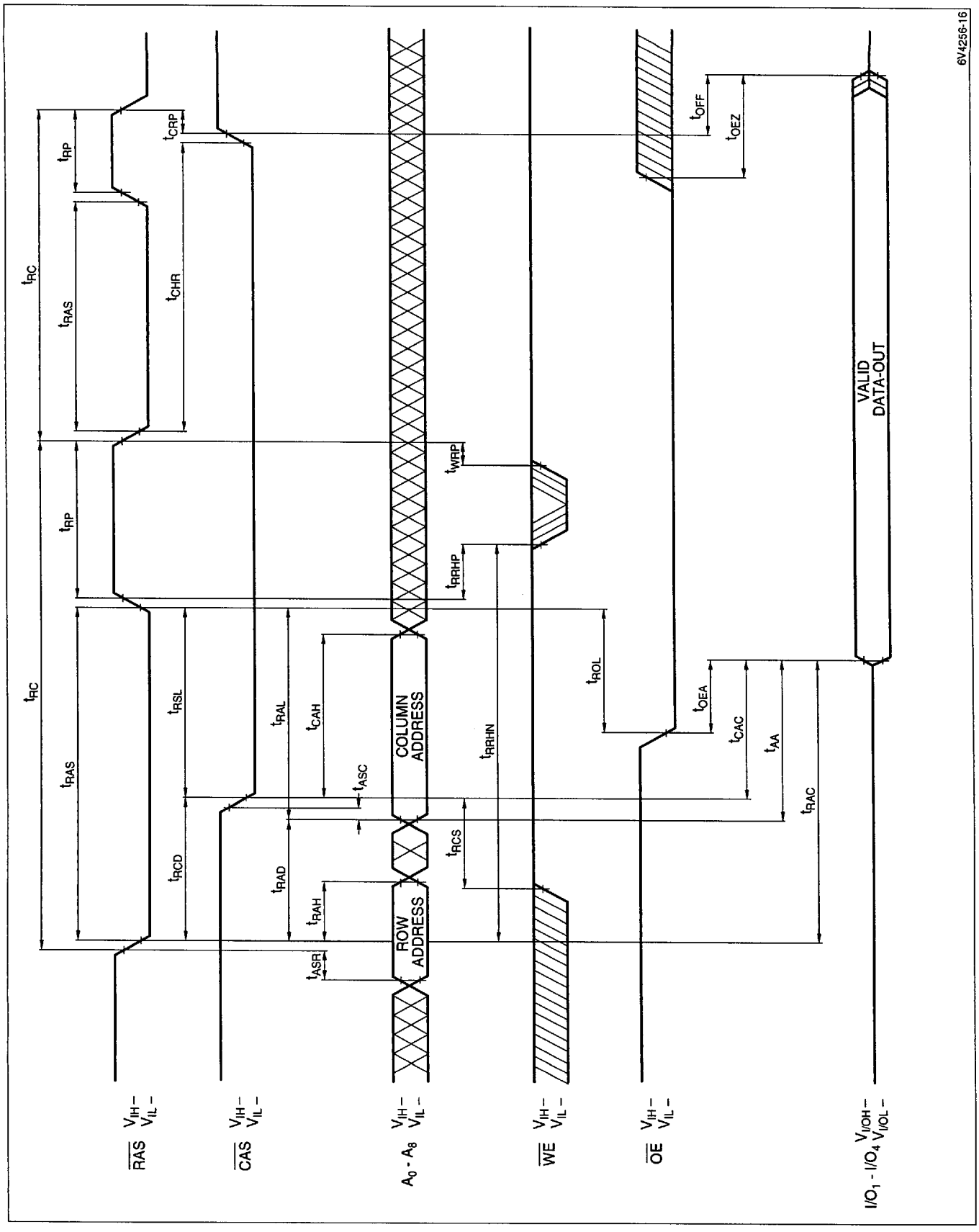
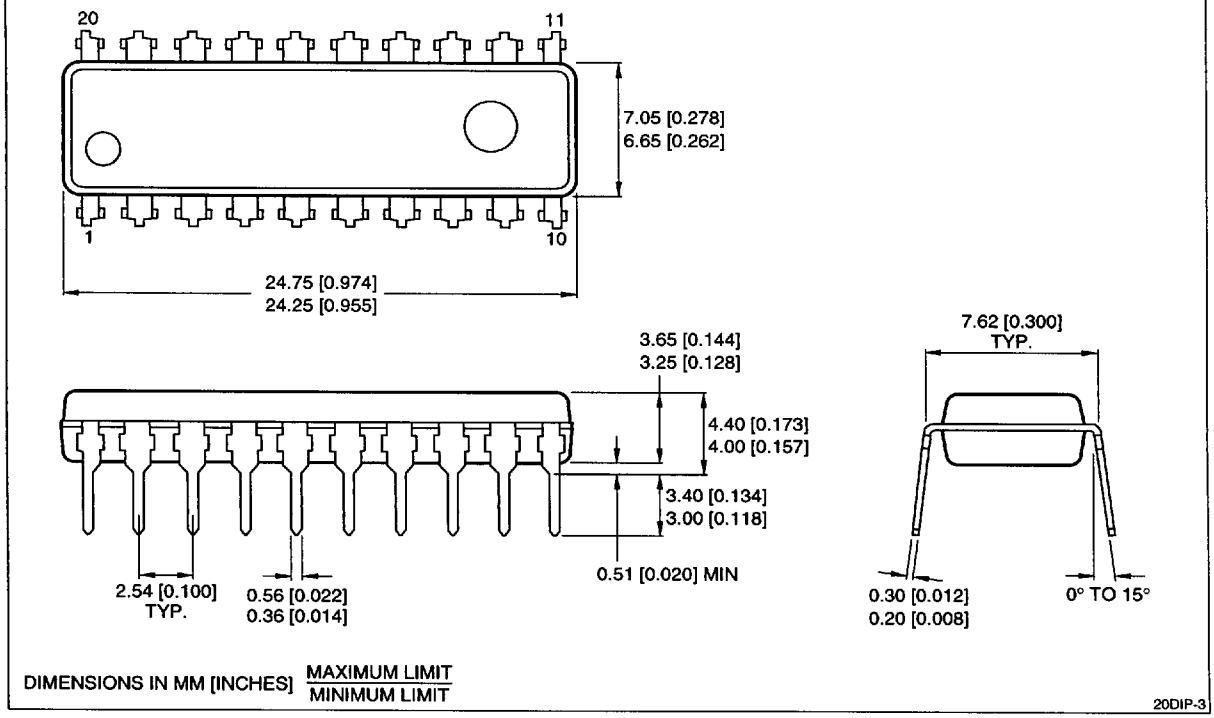


Figure 15. Hidden Refresh Cycle

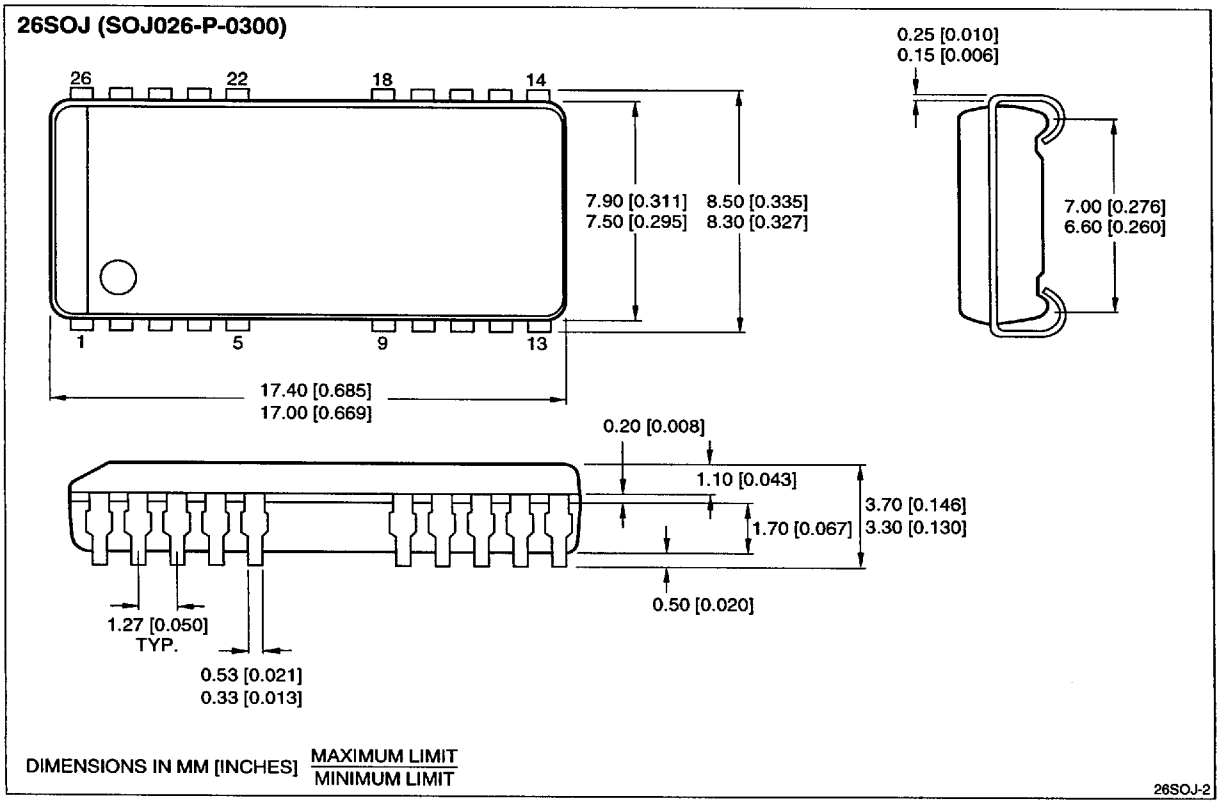
PACKAGE DIAGRAMS

20DIP (DIP020-P-0300A)



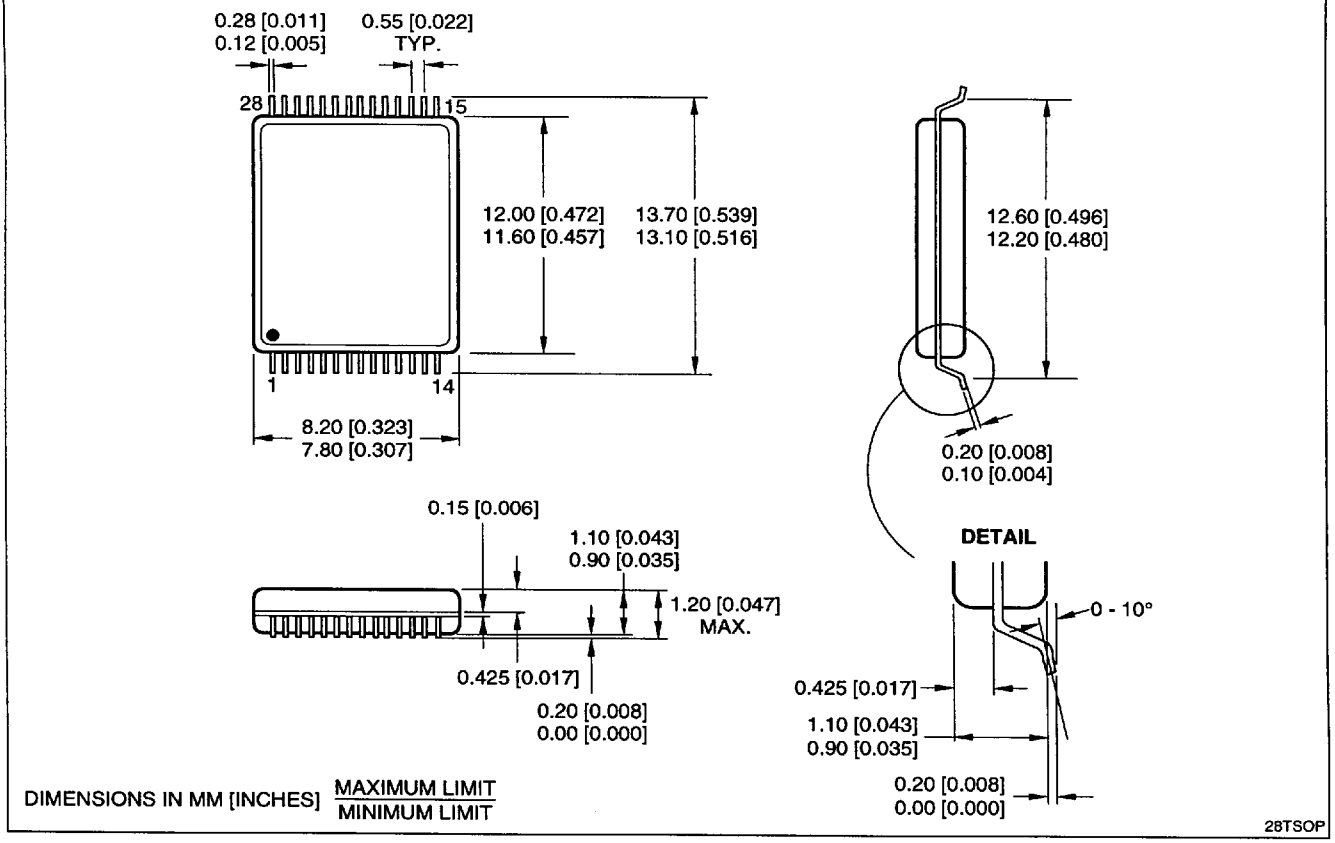
20-pin, 300-mil DIP

26SOJ (SOJ026-P-0300)



26-pin, 300-mil SOJ

28TSOP (TSOP028-P-0813)



28-pin, 8 × 13 mm² TSOP (Type I)

ORDERING INFORMATION