

Advance Information

16M CMOS Wide DRAM Family

EDO, 1M x 16, 1K, and 4K Refresh

The family of 16M Dynamic RAMs is fabricated using 0.50 μ CMOS high-speed silicon-gate process technology. It includes devices organized as 1,048,576 sixteen-bit words. Advanced circuit design and fine line processing provide high performance, improved reliability, and low cost.

The x16 with 4096 cycle refresh (MCM516165BV) require 12 address lines (12 rows, 8 columns), while the x16 device with 1024 cycle refresh (MCM518165BV) require only 10 address lines (10 rows, 10 columns).

These devices are packaged in a standard 400 mil J-lead small outline package (SOJ) and a standard 400 mil thin-small-outline package (TSOP).

- Single 3.3 V \pm 0.3 V Power Supply
- Three-State Data Outputs, x16 Configuration
- Extended Data Out (EDO)
- TTL-Compatible Inputs and Outputs
- RAS-Only Refresh
- CAS Before RAS Refresh
- Hidden Refresh
- 4096 Cycle Refresh:
MCM516165BV = 64 ms
- 1024 Cycle Refresh:
MCM518165BV = 16 ms
- Fast Access Time (t_{RAC}):
MCM51xxxBV-60 = 60 ns (Max)
MCM51xxxBV-70 = 70 ns (Max)
- Low Active Power Dissipation:
MCM516165BV-60 = 324 mW (Max)
MCM516165BV-70 = 270 mW (Max)
MCM518165BV-60 = 630 mW (Max)
MCM518165BV-70 = 522 mW (Max)
- Low Standby Power Dissipation:
All Devices = 3.6 mW (Max, TTL Levels)
All Devices = 1.8 mW (Max, CMOS Levels)

1M x 16

MCM516165BV

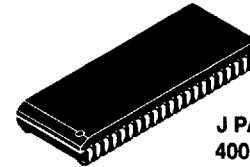
EDO

4096 Cycle Refresh

MCM518165BV

EDO

1024 Cycle Refresh



J PACKAGE
400 MIL SOJ
CASE 986A-01

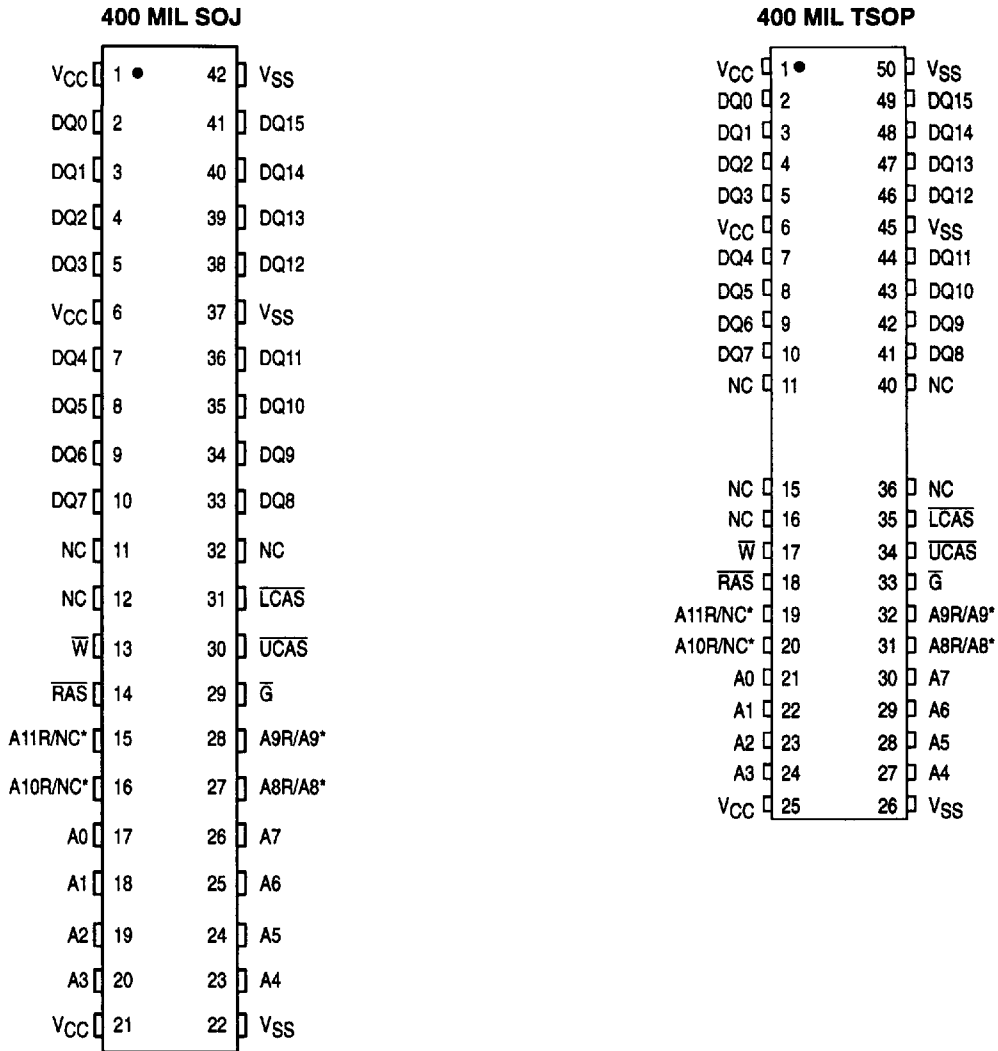


T PACKAGE
400 MIL TSOP II
CASE 985A-01

This document contains information on a new product. Specifications and information herein are subject to change without notice.



PIN ASSIGNMENTS

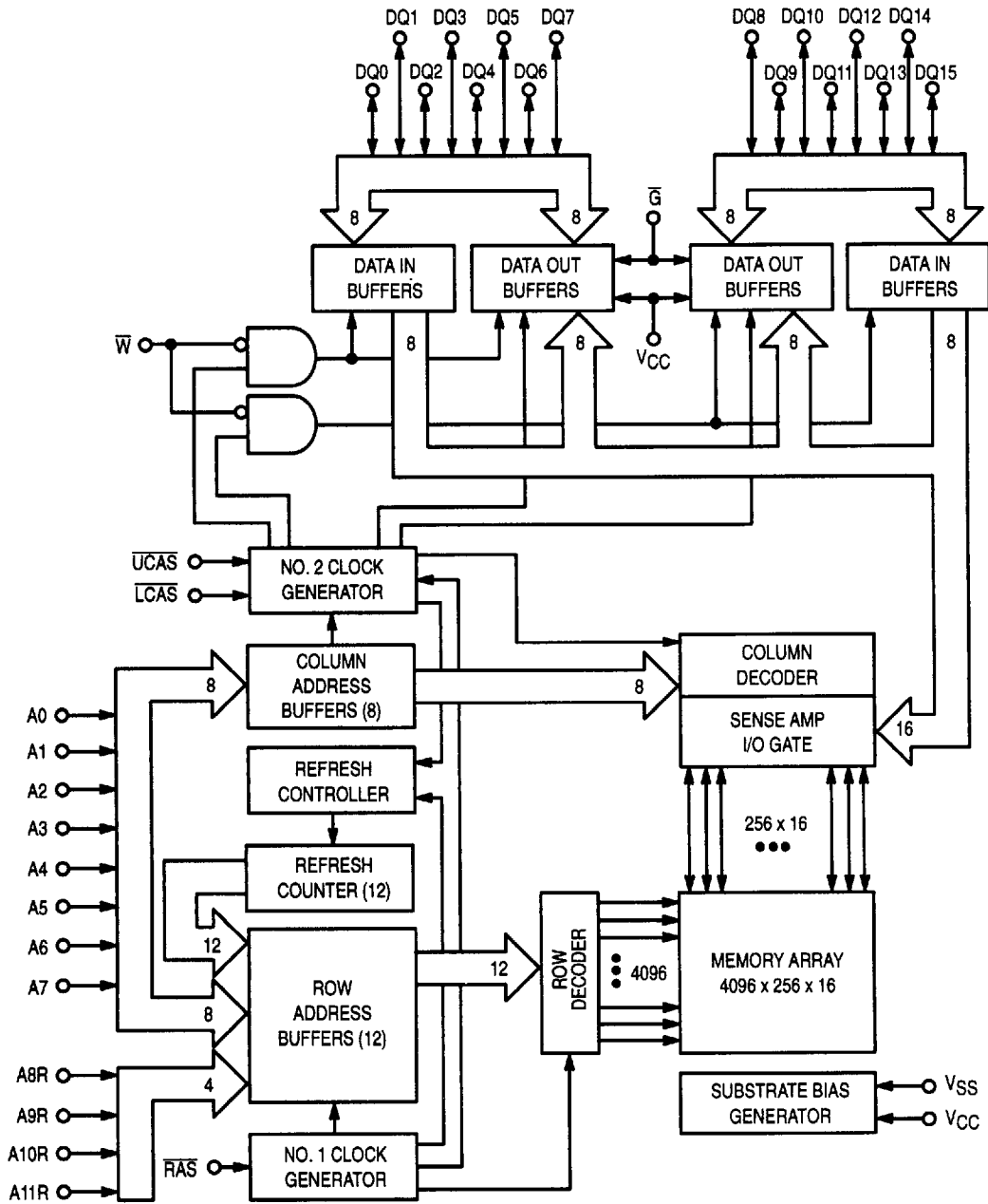


*4096 Cycle Refresh or 1024 Cycle Refresh (R Suffix = Row Address)

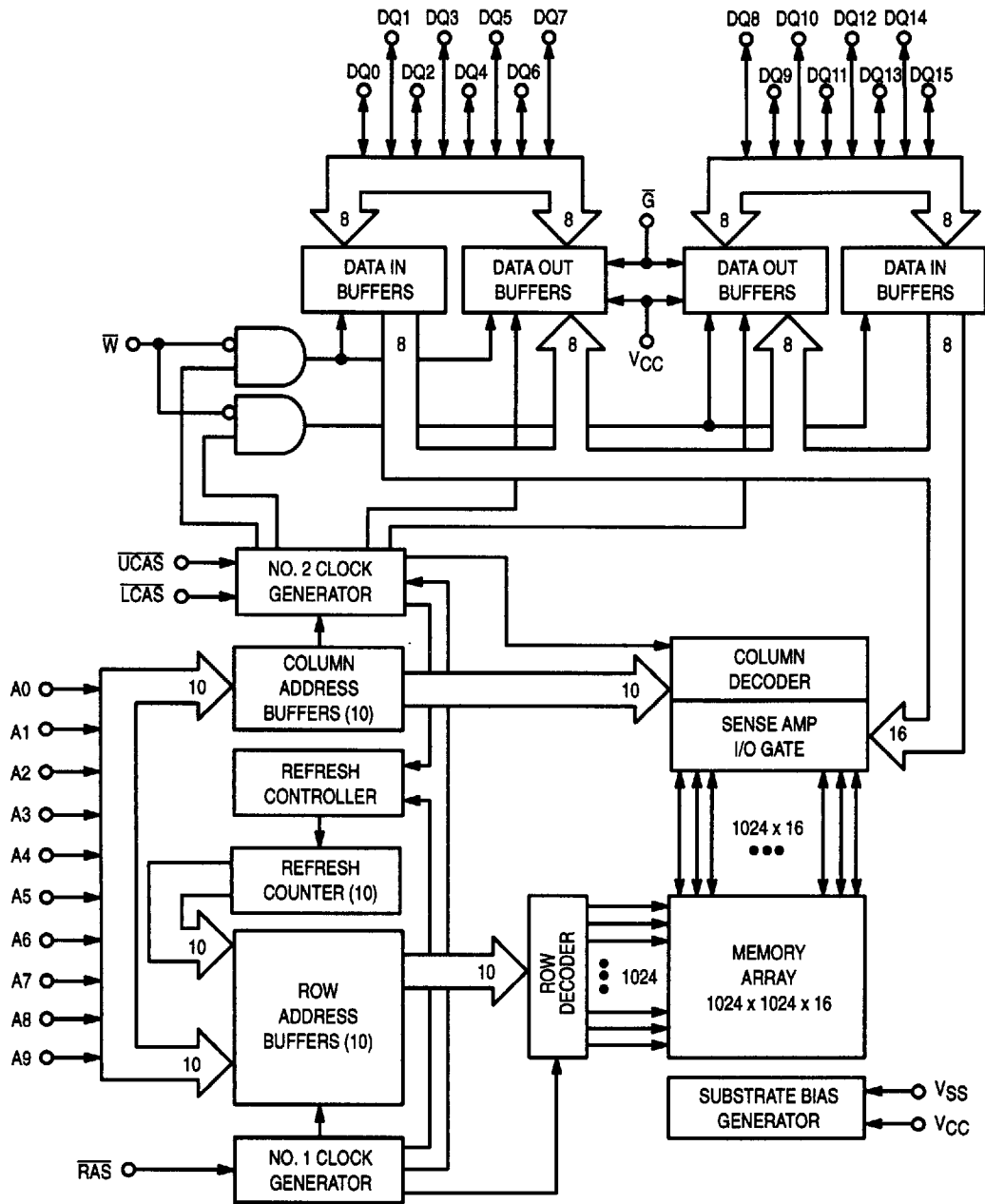
PIN NAMES			
A0 – A11	Address Input	LCAS	Column Address Strobe
DQ0 – DQ15	Data Input/Output	UCAS	Column Address Strobe
\bar{G}	Output Enable	VCC	Power Supply (+ 3.3 V)
\bar{W}	Read/Write Enable	VSS	Ground
\bar{RAS}	Row Address Strobe	NC	No Connection

BLOCK DIAGRAMS

MCM516165BV BLOCK DIAGRAM
1M x 16, 4096 CYCLE REFRESH



MCM518165BV BLOCK DIAGRAM
1M x 16, 1024 CYCLE REFRESH



ABSOLUTE MAXIMUM RATINGS (See Note)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	-0.3 to +4.6	V
Voltage Relative to V_{SS} , Any Pin Except V_{CC}	V_{in}, V_{out}	-0.3 to $V_{CC} + 0.3$	V
Data Out Current	I_{out}	50	mA
Soldering Temperature x Time	T_{solder}	260 x 10	°C x s
Power Dissipation	P_D	600 800	mW
Operating Temperature Range	T_A	0 to +70	°C
Storage Temperature Range	T_{stg}	-55 to +150	°C

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit.

NOTE: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to RECOMMENDED OPERATING CONDITIONS. Exposure to higher than recommended voltages for extended periods of time could affect device reliability.

DC OPERATING CONDITIONS AND CHARACTERISTICS

($V_{CC} = 3.3 V \pm 0.3 V$, $T_A = 0$ to $70^\circ C$, Unless Otherwise Noted)

RECOMMENDED OPERATING CONDITIONS (All voltages referenced to V_{SS})

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage (Operating Voltage Range)	V_{CC}	3.0	3.3	3.6	V
	V_{SS}	0	0	0	
Logic High Voltage, All Inputs	V_{IH}	2.2	—	$V_{CC} + 0.3^*$	V
Logic Low Voltage, All Inputs	V_{IL}	-0.3**	—	0.8	V

* $V_{CC} + 1.2 V$ at pulse width ≤ 20 ns.

** -1.2 V at pulse width ≤ 20 ns.

DC CHARACTERISTICS AND SUPPLY CURRENTS (All voltages referenced to V_{SS})

Characteristic	Symbol	MCM516165BV-60 MCM518165BV-60		MCM516165BV-70 MCM518165BV-70		Unit	Notes
		Min	Max	Min	Max		
V_{CC} Power Supply Current ($t_{RC} = t_{RC} \text{ Min}$) MCM516165BV-xx MCM518165BV-xx	I_{CC1}	—	90 175	—	75 145	mA	1, 2
V_{CC} Power Supply Current (Standby) ($\overline{RAS} = \overline{UCAS} = \overline{LCAS} = V_{IH}$)	I_{CC2}	—	1	—	1	mA	
V_{CC} Power Supply Current During \overline{RAS} Only Refresh Cycles ($\overline{UCAS} = \overline{LCAS} = V_{IH}$, $t_{RC} = t_{RC} \text{ Min}$) MCM516165BV-xx MCM518165BV-xx	I_{CC3}	—	90 175	—	75 145	mA	1, 2
V_{CC} Power Supply Current During Extended Data Out Cycle ($\overline{RAS} = V_{IL}$)	I_{CC4}	—	85 110	—	75 100	mA	1, 2
V_{CC} Power Supply Current (Standby) ($\overline{RAS} = \overline{UCAS} = \overline{LCAS} = V_{CC} - 0.2 V$)	I_{CC5}	—	0.5	—	0.5	mA	
V_{CC} Power Supply Current During \overline{CAS} Before \overline{RAS} Refresh Cycle ($t_{RC} = t_{RC} \text{ Min}$) MCM516165BV-xx MCM518165BV-xx	I_{CC6}	—	90 175	—	75 145	mA	1
Input Leakage Current ($0 V \leq V_{in} \leq V_{CC}$)	$I_{kg(I)}$	-10	10	-10	10	μA	
Output Leakage Current ($0 V \leq V_{out} \leq V_{CC}$, Output Disable)	$I_{kg(O)}$	-10	10	-10	10	μA	
Output High Voltage ($I_{OH} = -2 \text{ mA}$)	V_{OH}	2.4	—	2.4	—	V	
Output Low Voltage ($I_{OL} = 2 \text{ mA}$)	V_{OL}	—	0.4	—	0.4	V	

NOTES:

- Current is a function of cycle rate and output loading; maximum currents are specified cycle time (minimum) with the output open.
- Address may be changed once or less while $\overline{RAS} = V_{IL}$. In the case of I_{CC4} , it can be changed once or less during t_{EPC} .

CAPACITANCE ($f = 1.0 \text{ MHz}$, $T_A = 25^\circ C$, $V_{CC} = 3.3 V$, Periodically Sampled Rather Than 100% Tested)

Characteristic	Symbol	Max	Unit
Input Capacitance A0 - A11 $\overline{G}, \overline{RAS}, \overline{UCAS}, \overline{LCAS}, \overline{W}$	C_{in}	5	pF
		7	
Input/Output Capacitance ($\overline{UCAS}, \overline{LCAS} = V_{IH}$ to Disable Output) DQ0 - DQ15	C_{out}	7	pF

NOTE: Capacitance measured with a Boonton Meter or effective capacitance calculated from the equation: $C = I \Delta t / \Delta V$.

AC OPERATING CONDITIONS AND CHARACTERISTICS

($V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$, $T_A = 0\text{ to }70^\circ\text{C}$, Unless Otherwise Noted)

ALL DEVICES: READ, WRITE, AND READ-WRITE CYCLES (See Notes 1, 2, 3, and 4)

Parameter	Symbol		MCM516165BV-60 MCM518165BV-60		MCM516165BV-70 MCM518165BV-70		Unit	Notes
	Std	Alt	Min	Max	Min	Max		
Random Read or Write Cycle Time	t_{RELREL}	t_{RC}	104	—	124	—	ns	5
Read-Write Cycle Time	t_{RELREL}	t_{RWC}	135	—	157	—	ns	5
Access Time from \overline{RAS}	t_{RELQV}	t_{RAC}	—	60	—	70	ns	6, 7, 11, 12
Access Time from \overline{CAS}	t_{CELQV}	t_{CAC}	—	17	—	20	ns	6, 8, 11
Access Time from Column Address	t_{AVQV}	t_{AA}	—	30	—	35	ns	6, 9, 12
Access Time from Precharge \overline{CAS}	t_{CEHQV}	t_{CPA}	—	35	—	40	ns	6
\overline{CAS} to Output in Low-Z	t_{CELQX}	t_{CLZ}	0	—	0	—	ns	
Output Buffer and Turn-Off Delay	t_{CEHQZ}	t_{OFF}	0	15	0	15	ns	10, 16
Transition Time (Rise and Fall)	t_T	t_T	1	50	1	50	ns	
\overline{RAS} Precharge Time	t_{REHREL}	t_{RP}	40	—	50	—	ns	
\overline{RAS} Pulse Width	t_{RELREH}	t_{RAS}	60	10 k	70	10 k	ns	
\overline{RAS} Hold Time	t_{CELREH}	t_{RSH}	10	—	12	—	ns	
\overline{CAS} Hold Time	t_{RELCEH}	t_{CSH}	40	—	50	—	ns	
\overline{CAS} Pulse Width	t_{CELCEH}	t_{CAS}	10	10 k	12	10 k	ns	
\overline{RAS} to \overline{CAS} Delay Time	t_{RELCEL}	t_{RCD}	14	43	14	50	ns	11
\overline{RAS} to Column Address Delay Time	t_{RELAV}	t_{RAD}	12	30	12	35	ns	12
\overline{CAS} to \overline{RAS} Precharge Time	t_{CEHREL}	t_{CRP}	5	—	5	—	ns	
\overline{CAS} Precharge Time	t_{CEHCEL}	t_{CP}	10	—	10	—	ns	
Row Address Setup Time	t_{AVREL}	t_{ASR}	0	—	0	—	ns	
Row Address Hold Time	t_{RELAX}	t_{RAH}	10	—	10	—	ns	
Column Address Setup Time	t_{AVCEL}	t_{ASC}	0	—	0	—	ns	
Column Address Hold Time	t_{CELAX}	t_{CAH}	10	—	12	—	ns	
Column Address to \overline{RAS} Lead Time	t_{AVREH}	t_{RAL}	30	—	35	—	ns	
Read Command Setup Time	t_{WHCEL}	t_{RCS}	0	—	0	—	ns	

NOTES:

(continued)

1. V_{IH} (min) and V_{IL} (max) are reference levels for measuring timing of input signals. Transition times are measured between V_{IH} and V_{IL} .
2. An initial pause of 200 μs is required after power-up followed by 8 \overline{RAS} cycles before proper device operation is guaranteed. If using the internal refresh counter, a minimum of 8 \overline{CAS} before \overline{RAS} refresh cycles, instead of 8 \overline{RAS} only refresh cycles are required.
3. The transition time specification applies for all input signals. In addition to meeting the transition rate specification, all input signals must transition between V_{IH} and V_{IL} (or between V_{IL} and V_{IH}) in a monotonic manner.
4. AC measurements $t_T = 5.0\text{ ns}$.
5. The specification for t_{RC} (min), t_{RWC} (min), and t_{EPC} (min) is used only to indicate cycle time at which proper operation over the full temperature range ($0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$) is ensured.
6. Measured with a current load equivalent to 1 TTL (-2 mA , $+2\text{ mA}$) loads and 100 pF with the data output trip points set at $V_{OH} = 2.0\text{ V}$ and $V_{OL} = 0.8\text{ V}$.
7. Assumes that $t_{RCD} \leq t_{RCD}(\text{max})$.
8. Assumes that $t_{RCD} \geq t_{RCD}(\text{max})$.
9. Assumes that $t_{RAD} \geq t_{RAD}(\text{max})$.
10. $t_{OFF}(\text{max})$, $t_{REZ}(\text{max})$, $t_{WEZ}(\text{max})$, and $t_{GZ}(\text{max})$ define the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
11. Operation within the $t_{RCD}(\text{max})$ limit ensures that $t_{RAC}(\text{max})$ can be met. $t_{RCD}(\text{max})$ is specified as a reference point only; if t_{RCD} is greater than the specified $t_{RCD}(\text{max})$ limit, then access time is controlled exclusively by t_{CAC} .
12. Operation within the $t_{RAD}(\text{max})$ limit ensures that $t_{RAC}(\text{max})$ can be met. $t_{RAD}(\text{max})$ is specified as a reference point only; if t_{RAD} is greater than the specified $t_{RAD}(\text{max})$, then access time is controlled exclusively by t_{AA} .

ALL DEVICES: READ, WRITE, AND READ-WRITE CYCLES (Continued)

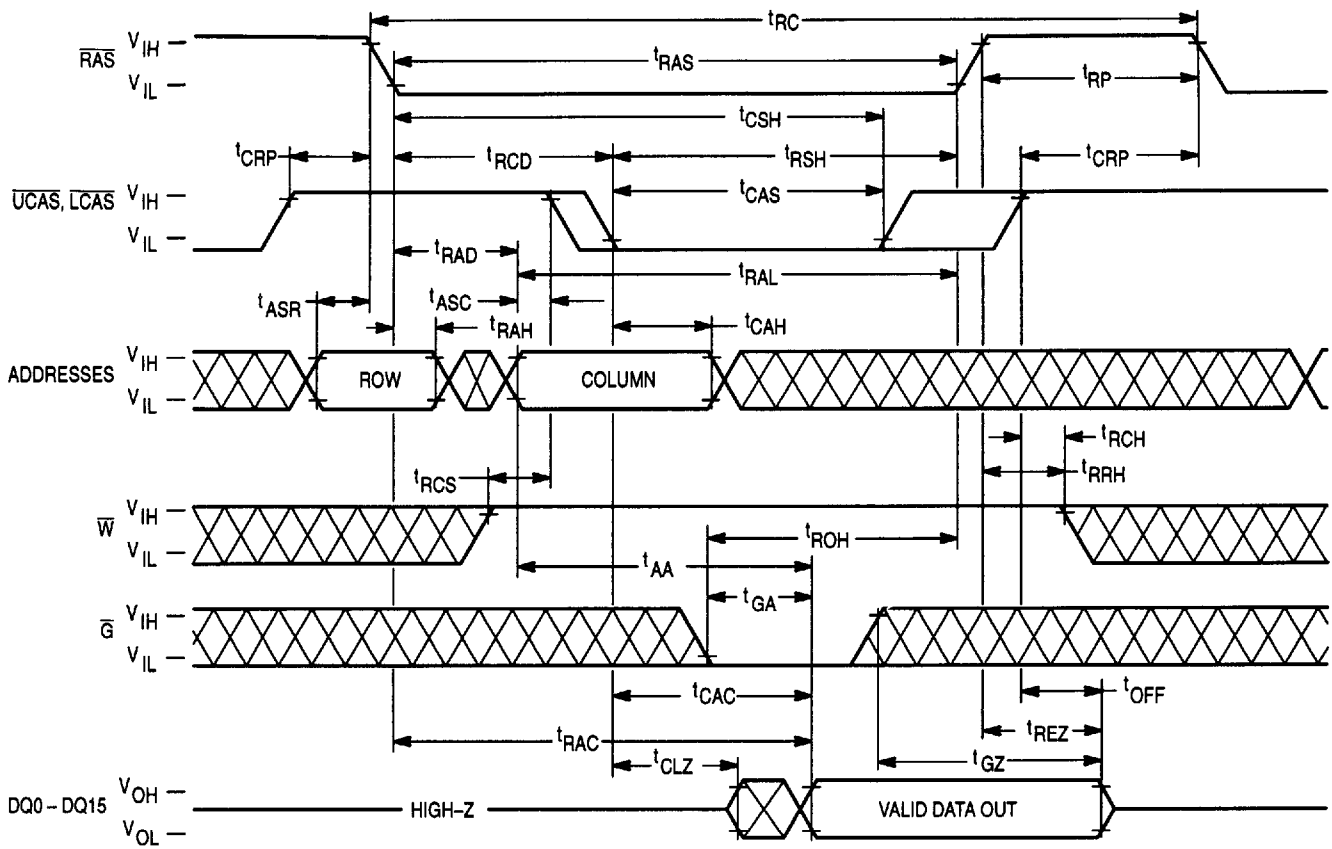
Parameter	Symbol		MCM516165BV-60 MCM518165BV-60		MCM516165BV-70 MCM518165BV-70		Unit	Notes	
	Std	Alt	Min	Max	Min	Max			
Read Command Hold Time Referenced to $\overline{\text{CAS}}$	t _{CEHWX}	t _{RCH}	0	—	0	—	ns	13	
Read Command Hold Time Referenced to $\overline{\text{RAS}}$	t _{REHWX}	t _{RRH}	0	—	0	—	ns	13	
Write Command Hold Time Referenced to $\overline{\text{CAS}}$	t _{CELWH}	t _{WCH}	10	—	12	—	ns		
Write Command Pulse Width	t _{WLWH}	t _{WP}	10	—	12	—	ns		
Write Command to $\overline{\text{RAS}}$ Lead Time	t _{WLREH}	t _{RWL}	10	—	12	—	ns		
Write Command to $\overline{\text{CAS}}$ Lead Time	t _{WLCEH}	t _{CWL}	10	—	12	—	ns		
Data In Setup Time	t _{DVCEL}	t _{DS}	0	—	0	—	ns	14	
Data In Hold Time	t _{CELDX}	t _{DH}	10	—	12	—	ns	14	
Refresh Period	MCM516165BV MCM518165BV	t _{RVRV}	t _{RFSH}	—	64 16	—	64 16	ms	
Write Command Setup Time	t _{WLCEL}	t _{WCS}	0	—	0	—	ns	15	
$\overline{\text{CAS}}$ to Write Delay	t _{CELWL}	t _{CWD}	36	—	39	—	ns	15	
$\overline{\text{RAS}}$ to Write Delay	t _{RELWL}	t _{RWD}	79	—	89	—	ns	15	
Column Address to Write Delay	t _{AVWL}	t _{AWD}	49	—	54	—	ns	15	
$\overline{\text{CAS}}$ Precharge to Write Delay	t _{CEHWL}	t _{CPWD}	54	—	59	—	ns	15	
$\overline{\text{CAS}}$ Setup Time for $\overline{\text{CAS}}$ Before $\overline{\text{RAS}}$ Refresh	t _{CELC}	t _{CSR}	5	—	5	—	ns		
$\overline{\text{CAS}}$ Hold Time for $\overline{\text{CAS}}$ Before $\overline{\text{RAS}}$ Refresh	t _{RELCEH}	t _{CHR}	10	—	15	—	ns		
$\overline{\text{RAS}}$ Precharge to $\overline{\text{CAS}}$ Active Time	t _{REHCEL}	t _{RPC}	5	—	5	—	ns		
$\overline{\text{CAS}}$ Precharge Time for $\overline{\text{CAS}}$ Before $\overline{\text{RAS}}$ Counter Test	t _{CEHCEL}	t _{CPT}	20	—	20	—	ns		
$\overline{\text{RAS}}$ Hold Time Referenced to $\overline{\text{G}}$	t _{GLREH}	t _{ROH}	10	—	10	—	ns		
$\overline{\text{G}}$ Access Time	t _{GLQV}	t _{GA}	—	15	—	20	ns	6	
$\overline{\text{G}}$ to Data Delay	t _{GLHDX}	t _{GD}	15	—	15	—	ns		
Output Buffer Turn-Off Delay from $\overline{\text{G}}$	t _{GHQZ}	t _{GZ}	0	15	0	15	ns	10	
$\overline{\text{G}}$ Command Hold Time	t _{WLGL}	t _{GH}	10	—	12	—	ns		
Output Disable Setup Time	t _{GHCEL}	t _{GDS}	0	—	0	—	ns		
$\overline{\text{RAS}}$ Hold Time from $\overline{\text{CAS}}$ Precharge (Extended Data Out)	t _{CEHREH}	t _{RHCP}	35	—	40	—	ns		
$\overline{\text{RAS}}$ Pulse Width (Extended Data Out)	t _{RELREH}	t _{RASP}	60	100 k	70	100 k	ns		
$\overline{\text{RAS}}$ to Next $\overline{\text{CAS}}$ Delay (Extended Data Out)	t _{RELCEL}	t _{RNCD}	60	—	70	—	ns		
Extended Data Out Cycle Time	t _{CELC}	t _{EPC}	25	—	30	—	ns		
Extended Data Out Read-Write Cycle Time	t _{CELC}	t _{ERWC}	68	—	75	—	ns		
Output Data Hold Time	t _{CELQZ}	t _{COH}	5	—	5	—	ns		
Output Buffer Turn-Off Delay from $\overline{\text{RAS}}$	t _{REHQZ}	t _{REZ}	0	15	0	15	ns	10, 16	
Output Buffer Turn-Off Delay from $\overline{\text{WE}}$	t _{WLQZ}	t _{WEZ}	0	15	0	15	ns	10	
$\overline{\text{WE}}$ to Data Delay	t _{WLDV}	t _{WED}	15	—	15	—	ns		
$\overline{\text{G}}$ to Pulse Width	t _{GLGH}	t _G	15	—	20	—	ns		
$\overline{\text{G}}$ Precharge Time	t _{GHGL}	t _{GP}	10	—	12	—	ns		
$\overline{\text{CAS}}$ to $\overline{\text{G}}$ Precharge Time	t _{CEHGL}	t _{CPG}	5	—	5	—	ns		

NOTES:

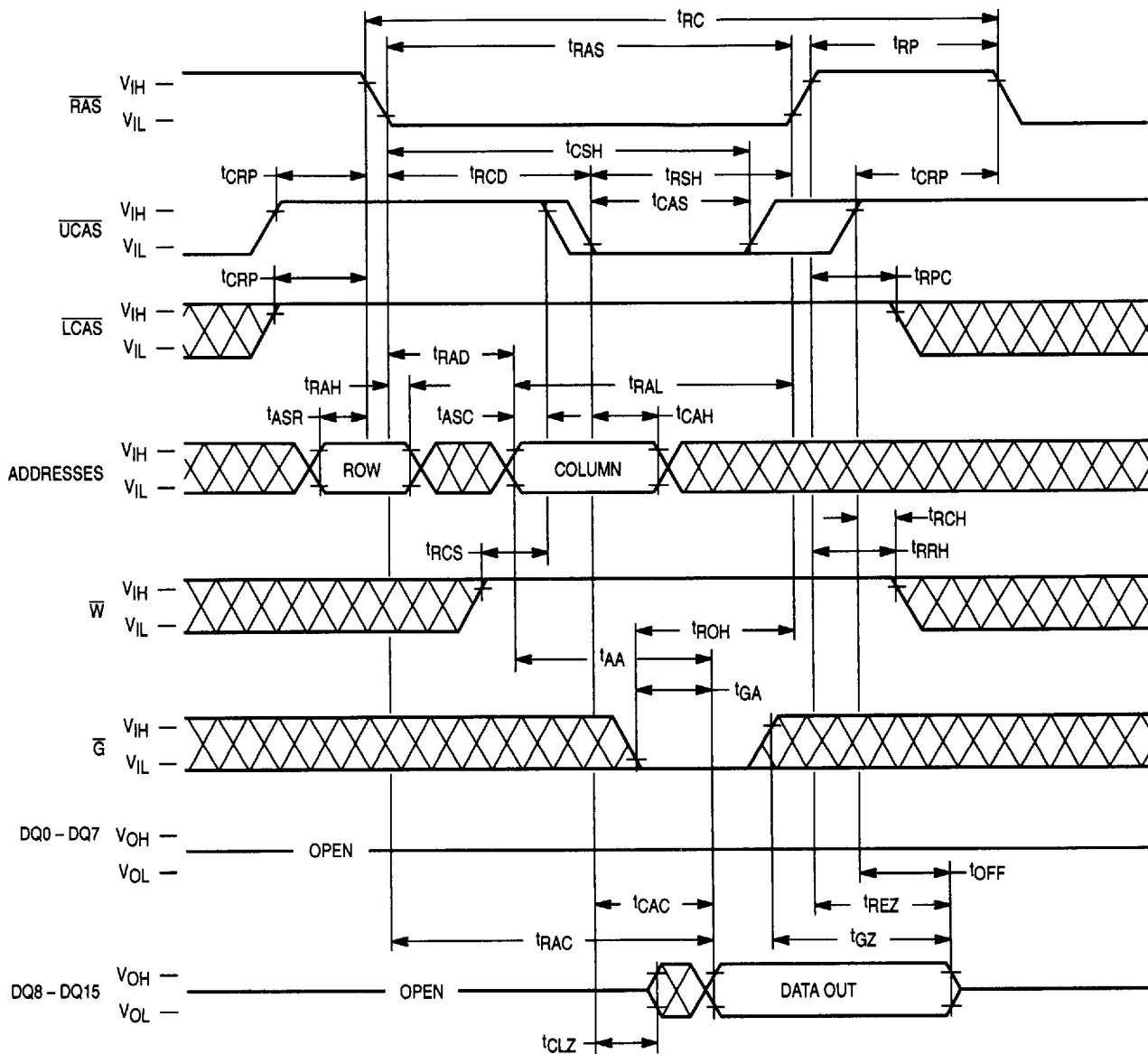
- Either t_{RRH} or t_{RCH} must be satisfied for a read cycle.
- These parameters are referenced to $\overline{\text{UCAS}}$ or $\overline{\text{LCAS}}$ leading edge in early write cycles and to $\overline{\text{W}}$ leading edge in late write or read-write cycles.
- t_{WCS}, t_{RWD}, t_{CWD}, t_{AWD}, and t_{CPWD} are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only; if t_{WCS} ≥ t_{WCS} (min), the cycle is an early write cycle and the data out pin will remain open circuit (high impedance) throughout the entire cycle; if t_{CWD} ≥ t_{CWD} (min), t_{RWD} ≥ t_{RWD} (min), t_{AWD} ≥ t_{AWD} (min), and t_{CPWD} ≥ t_{CPWD} (min) (extended data out), the cycle is a read-write cycle and the data out will contain data read from the selected cell. If neither of these sets of conditions is satisfied, the condition of the data out (at access time) is indeterminate.
- If $\overline{\text{RAS}}$ goes high before $\overline{\text{CAS}}$ goes high, the open circuit condition is controlled by $\overline{\text{CAS}}$ going high (t_{OFF}). If $\overline{\text{CAS}}$ goes high before $\overline{\text{RAS}}$ goes high, the open circuit condition is controlled by $\overline{\text{RAS}}$ going high (t_{REZ}).

TIMING DIAGRAMS

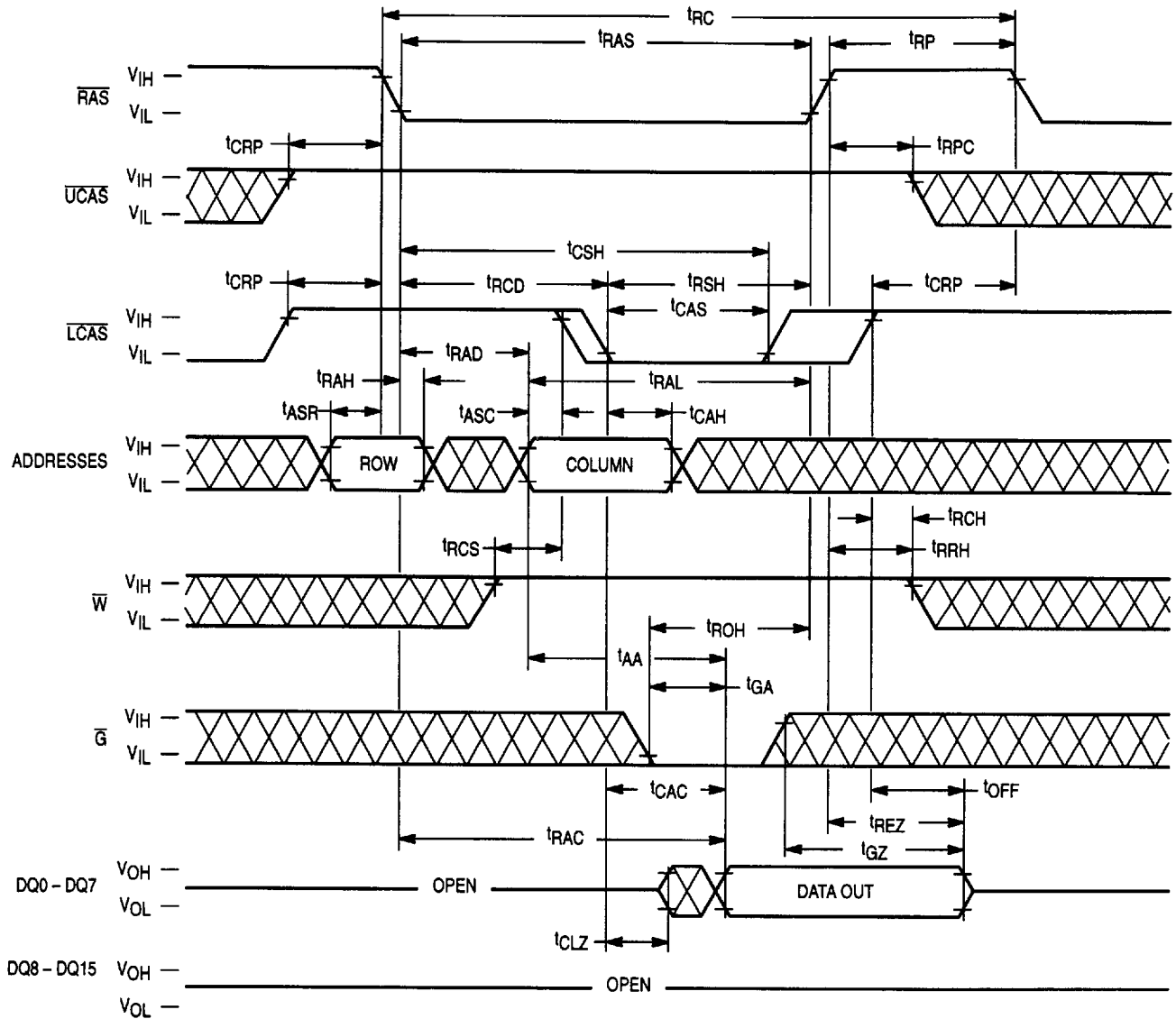
READ CYCLE



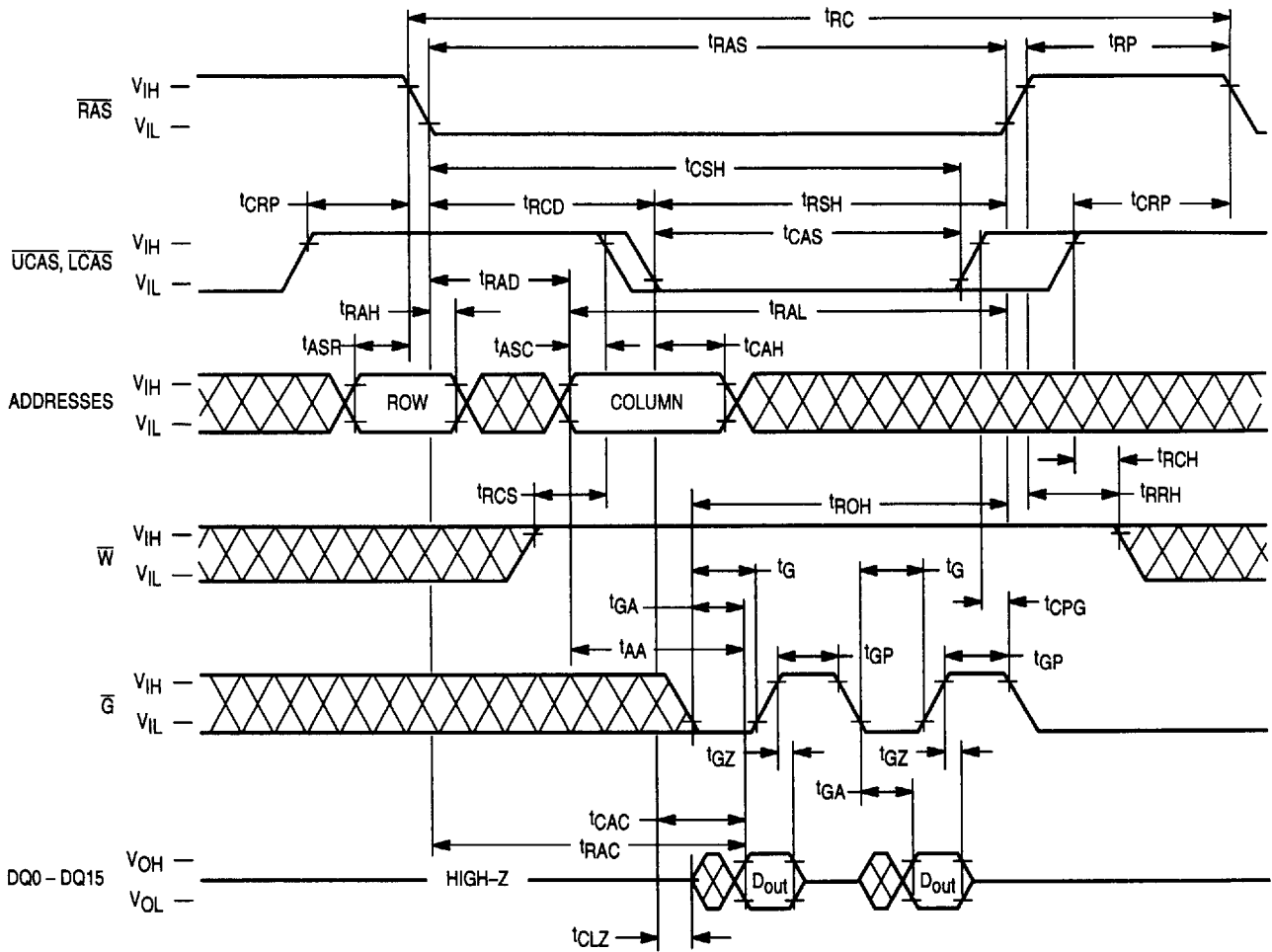
UPPER BYTE READ CYCLE



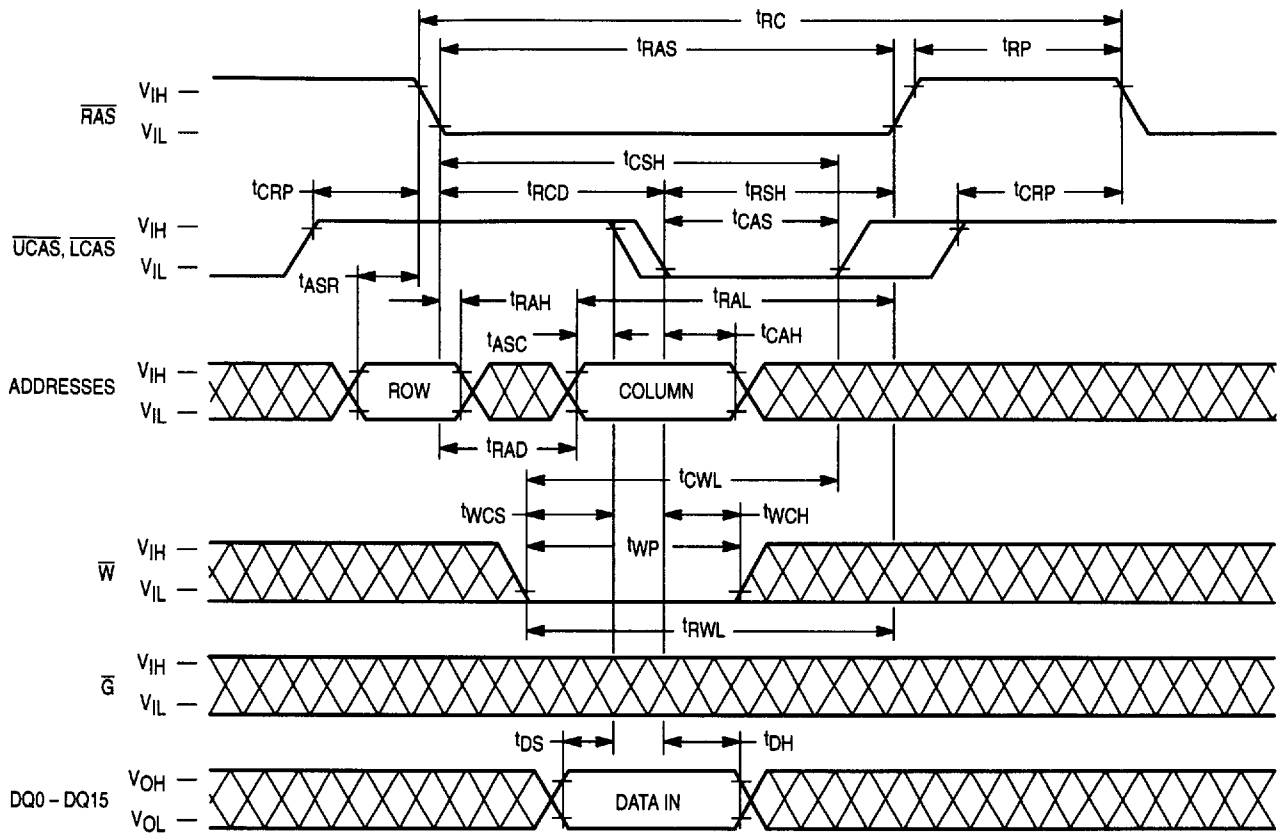
LOWER BYTE READ CYCLE



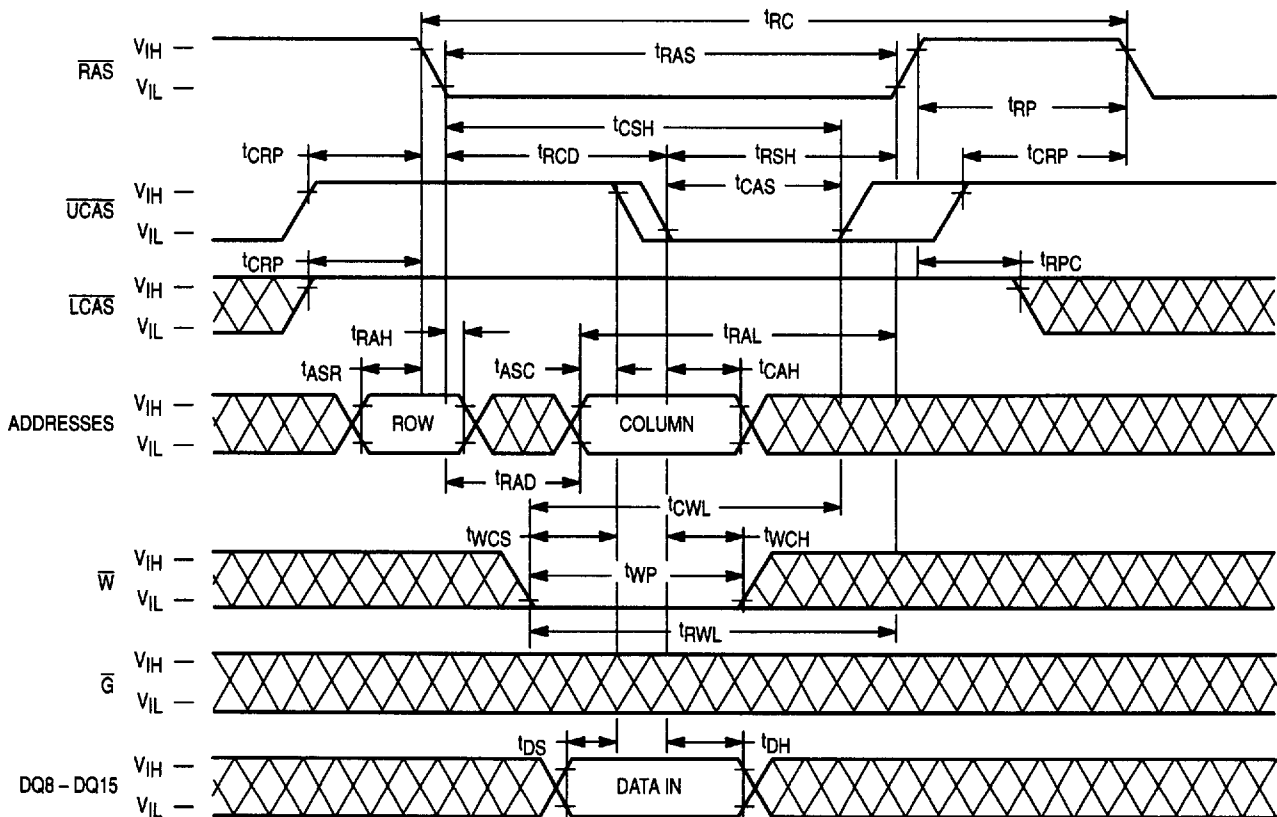
READ CYCLE (\bar{G} CONTROLLED READ)



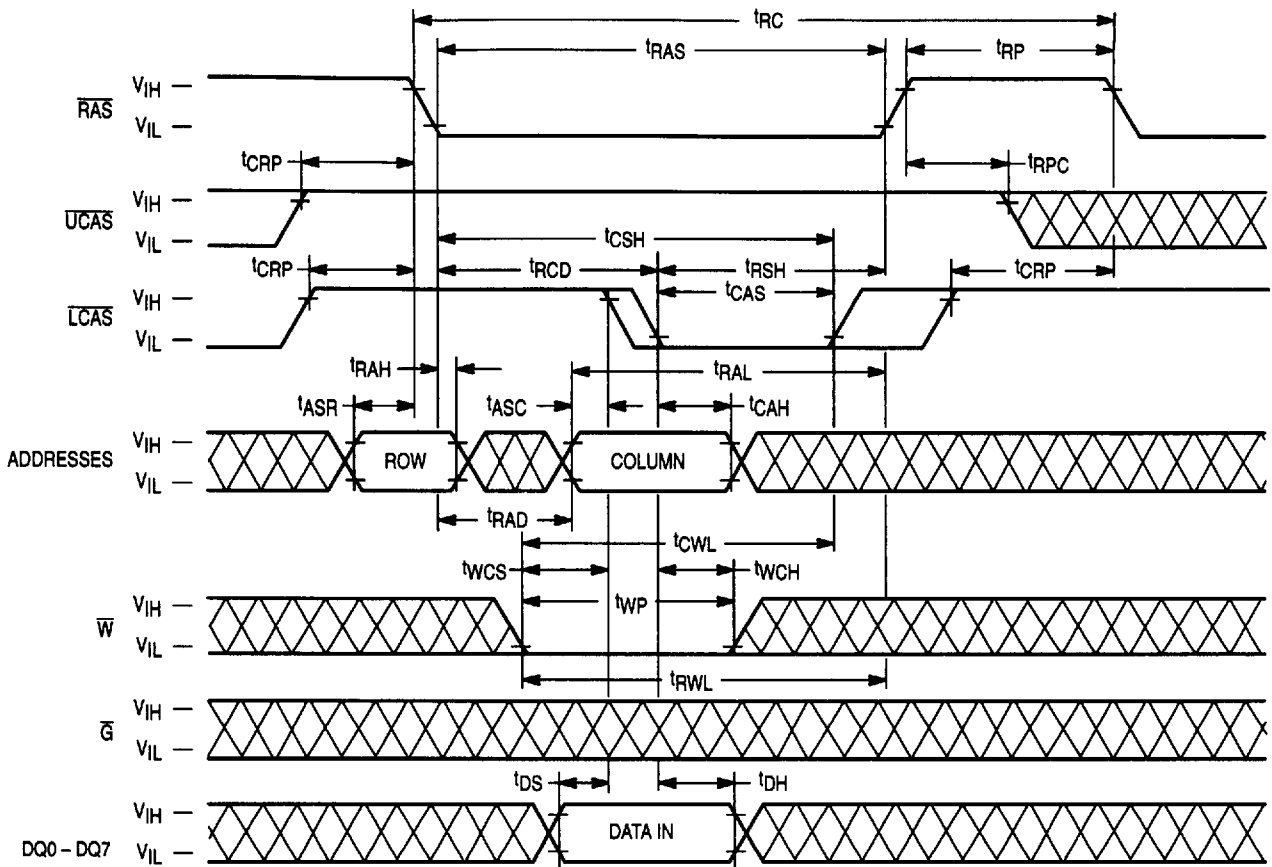
WRITE CYCLE (EARLY WRITE)



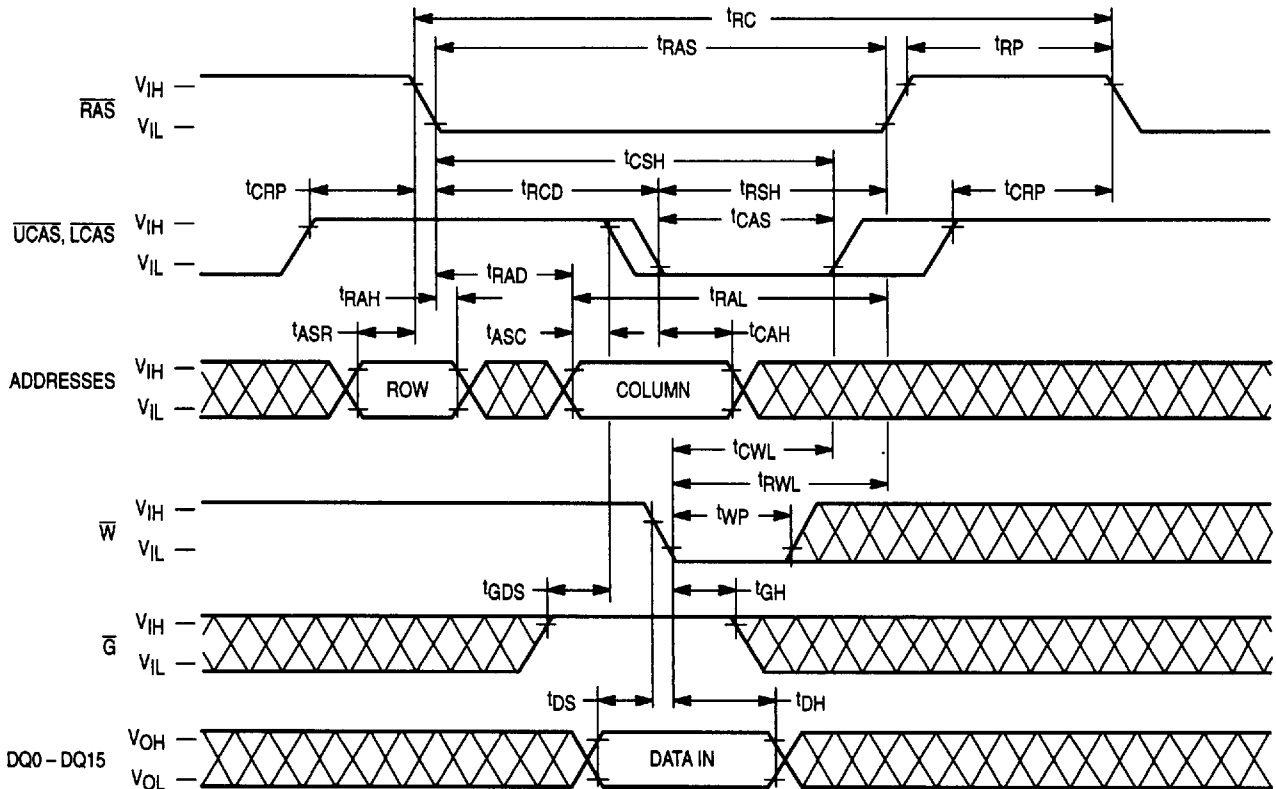
UPPER BYTE WRITE CYCLE (EARLY WRITE)



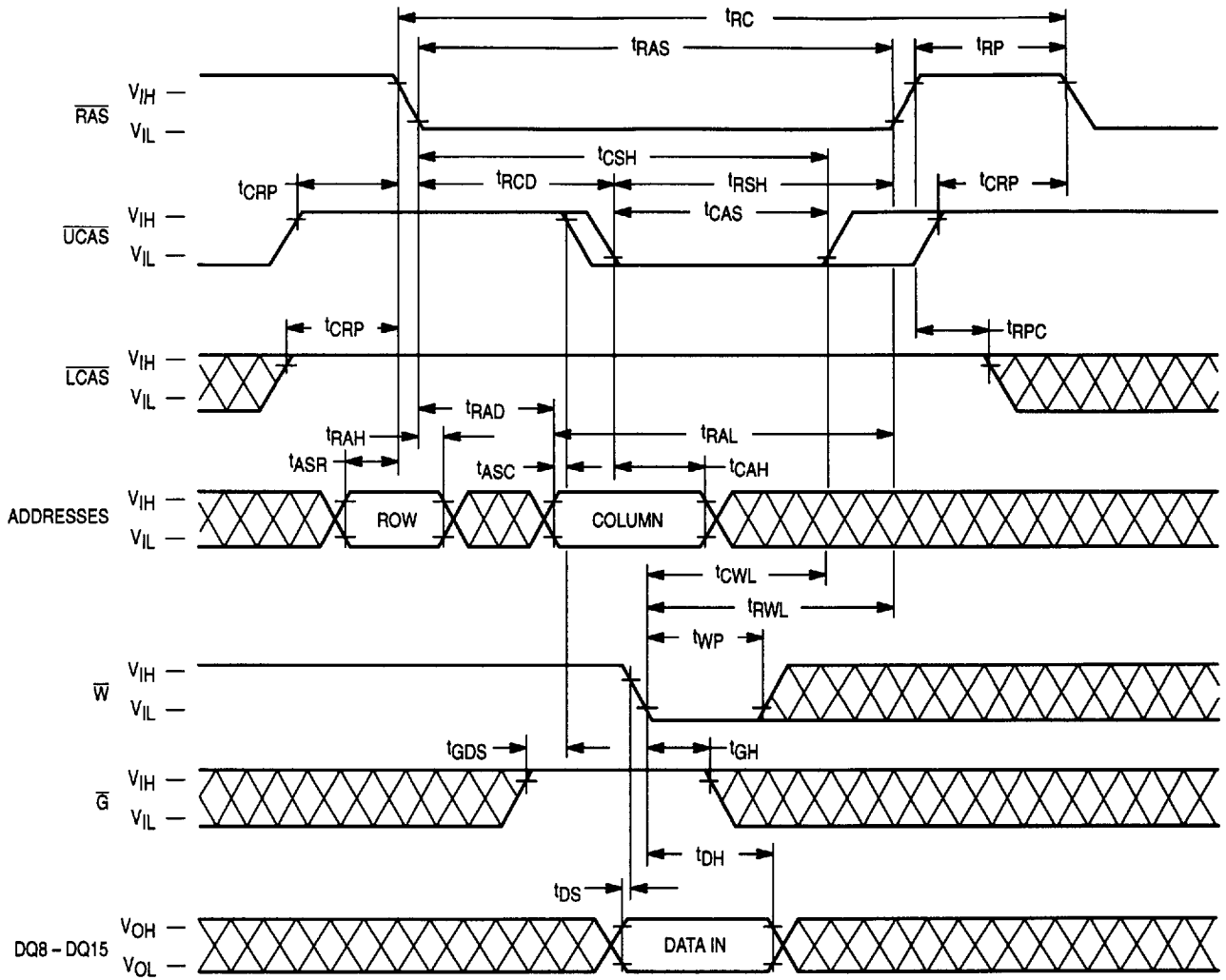
LOWER BYTE WRITE CYCLE (EARLY WRITE)



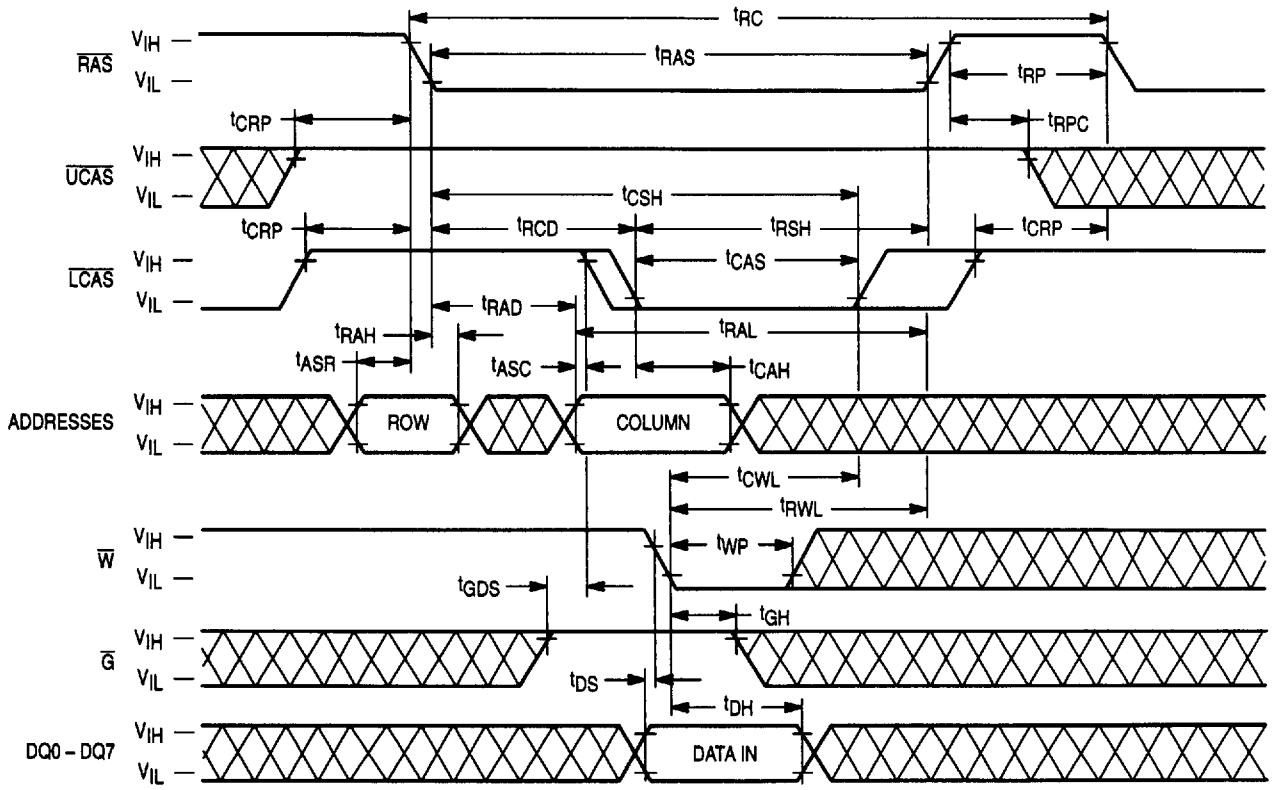
WRITE CYCLE (\bar{G} CONTROLLED WRITE)



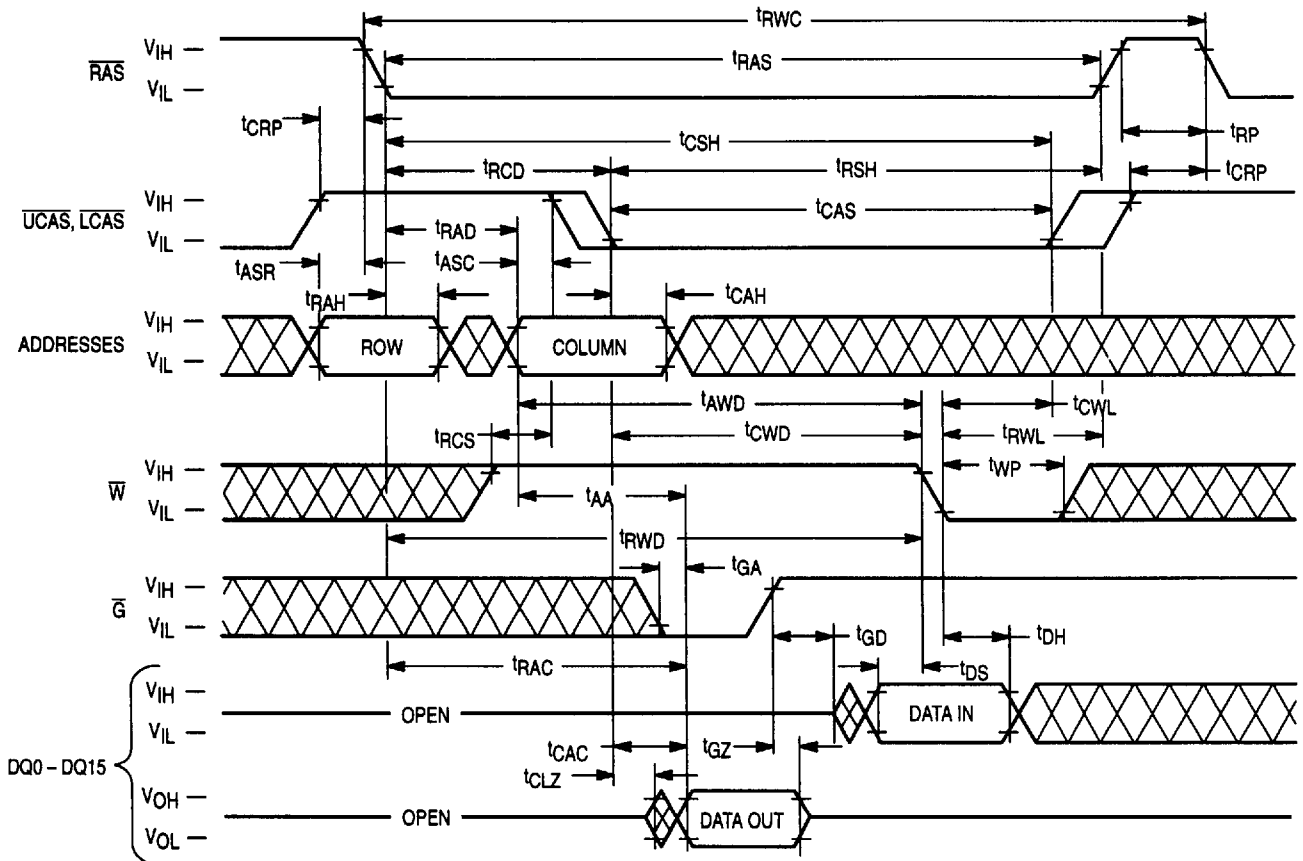
UPPER BYTE WRITE CYCLE (\bar{G} CONTROLLED WRITE)



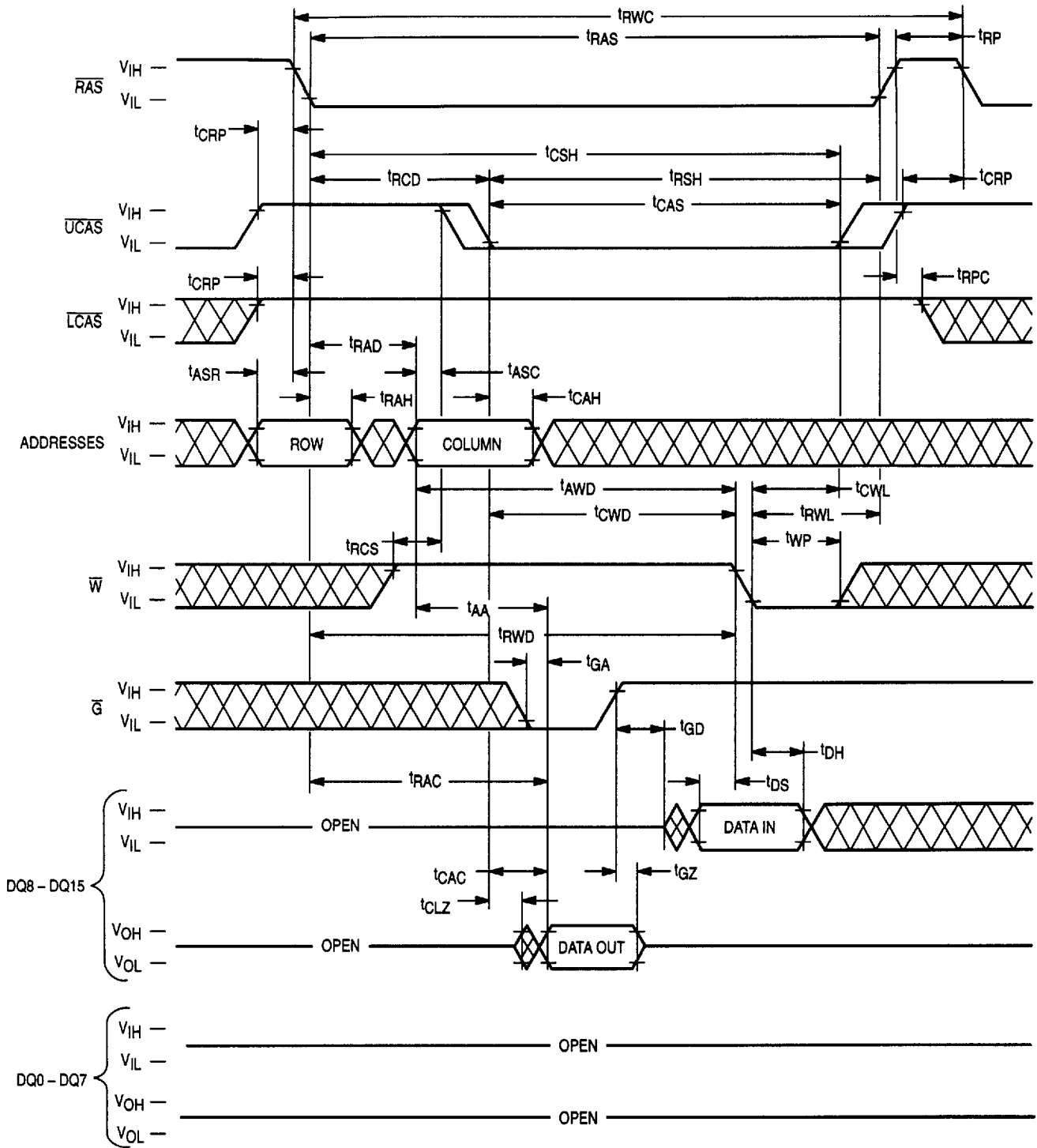
LOWER BYTE WRITE CYCLE (\bar{G} CONTROLLED WRITE)



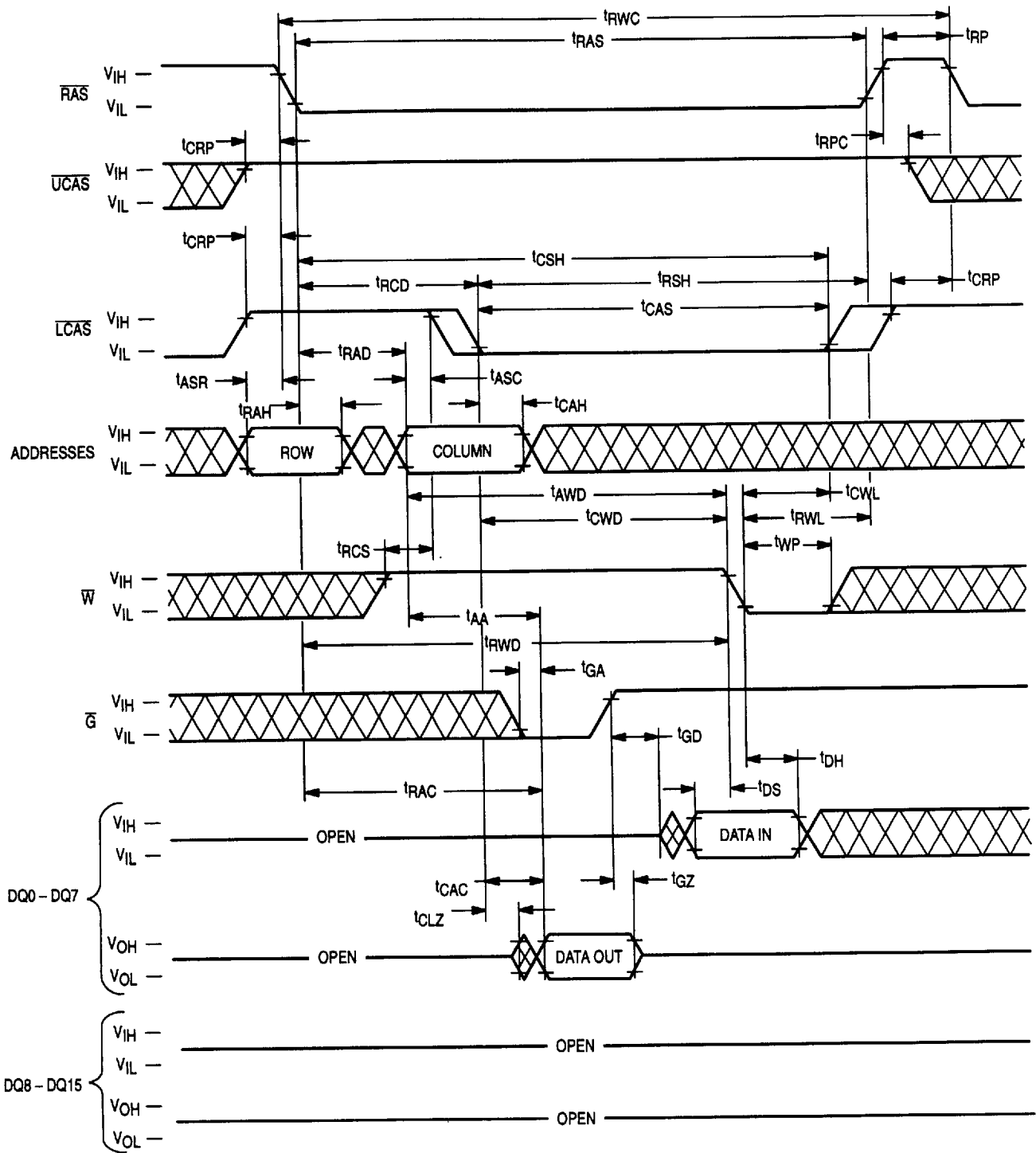
READ-WRITE CYCLE



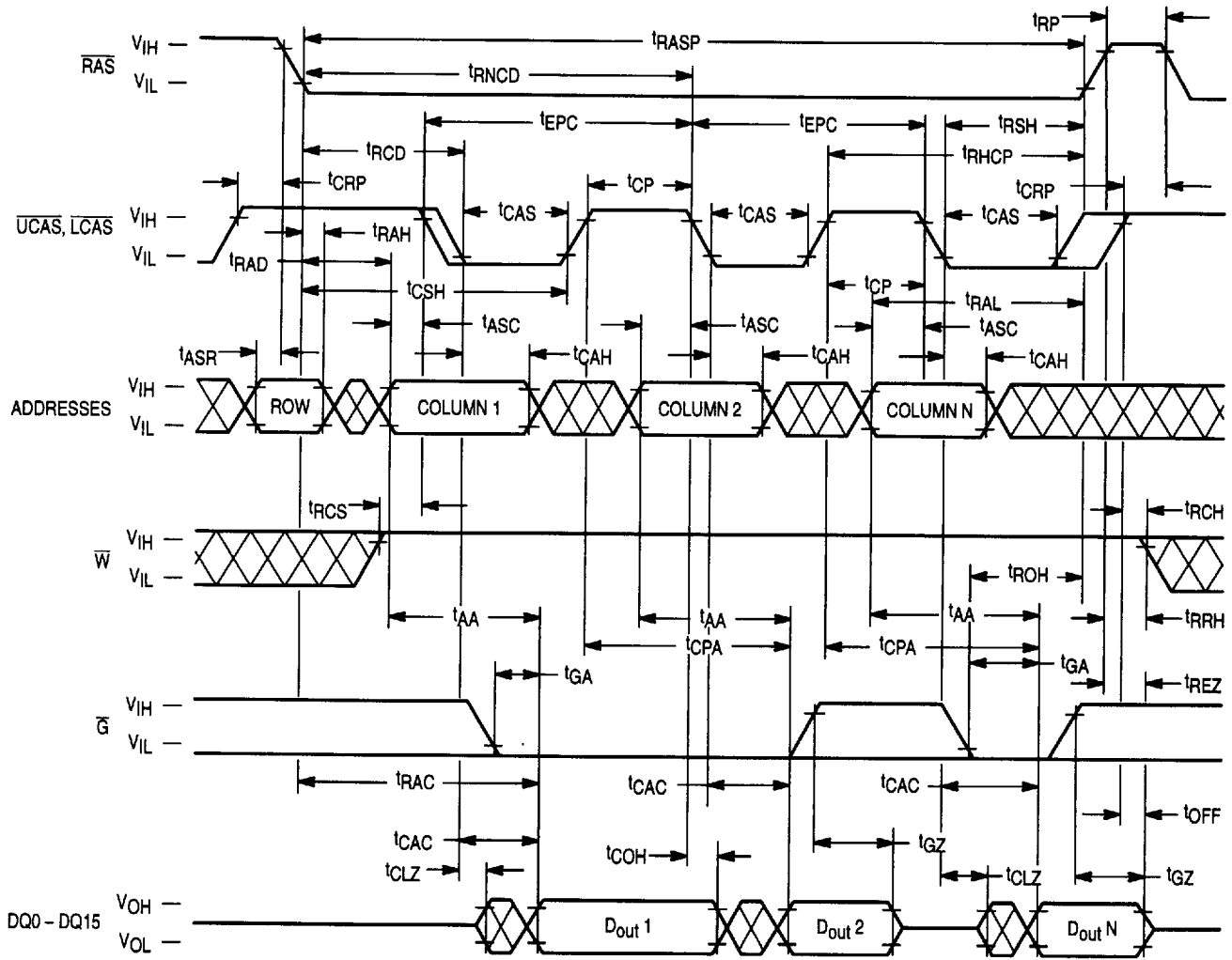
UPPER BYTE READ-WRITE CYCLE



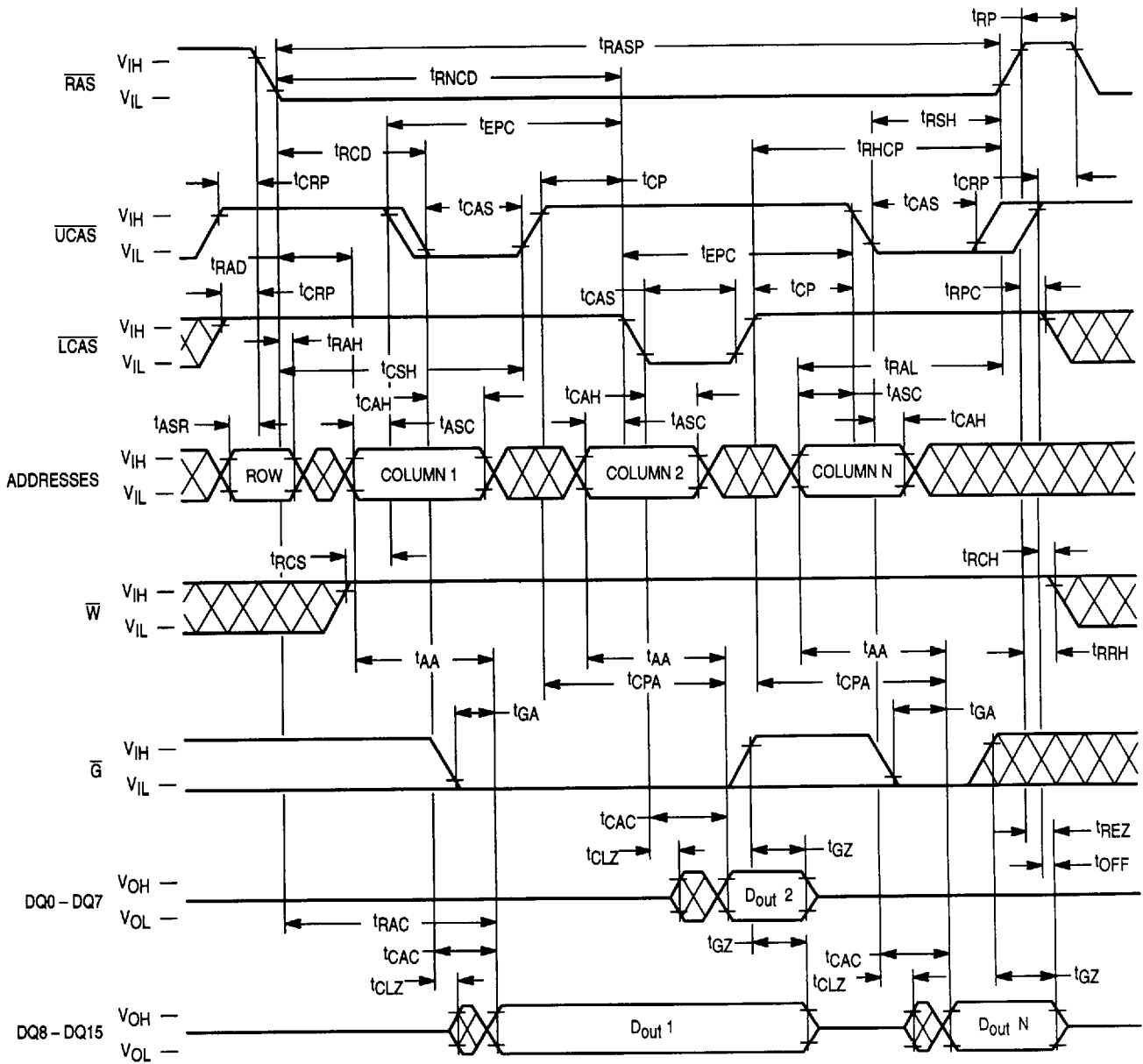
LOWER BYTE READ-WRITE CYCLE



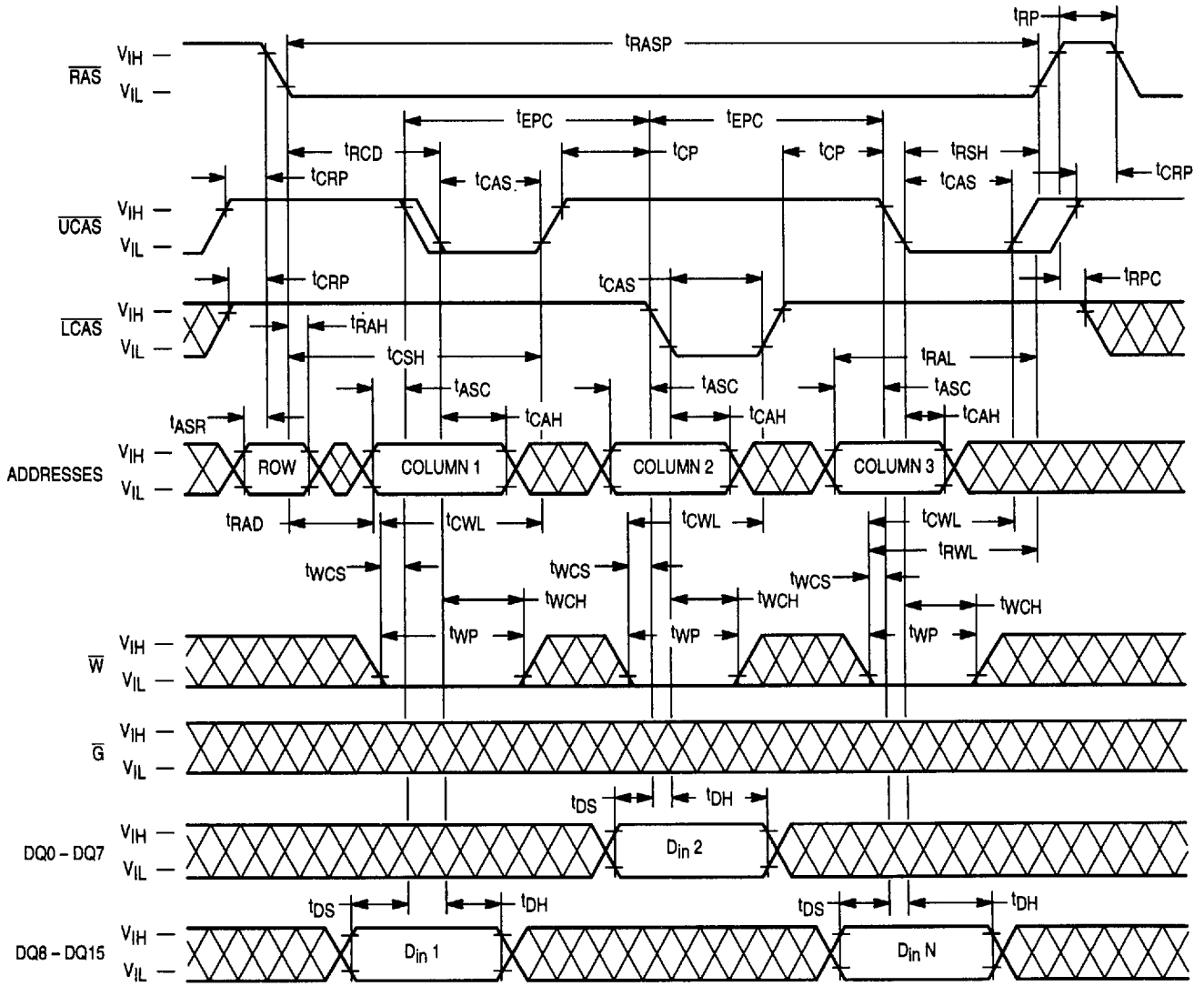
EXTENDED DATA OUT READ CYCLE



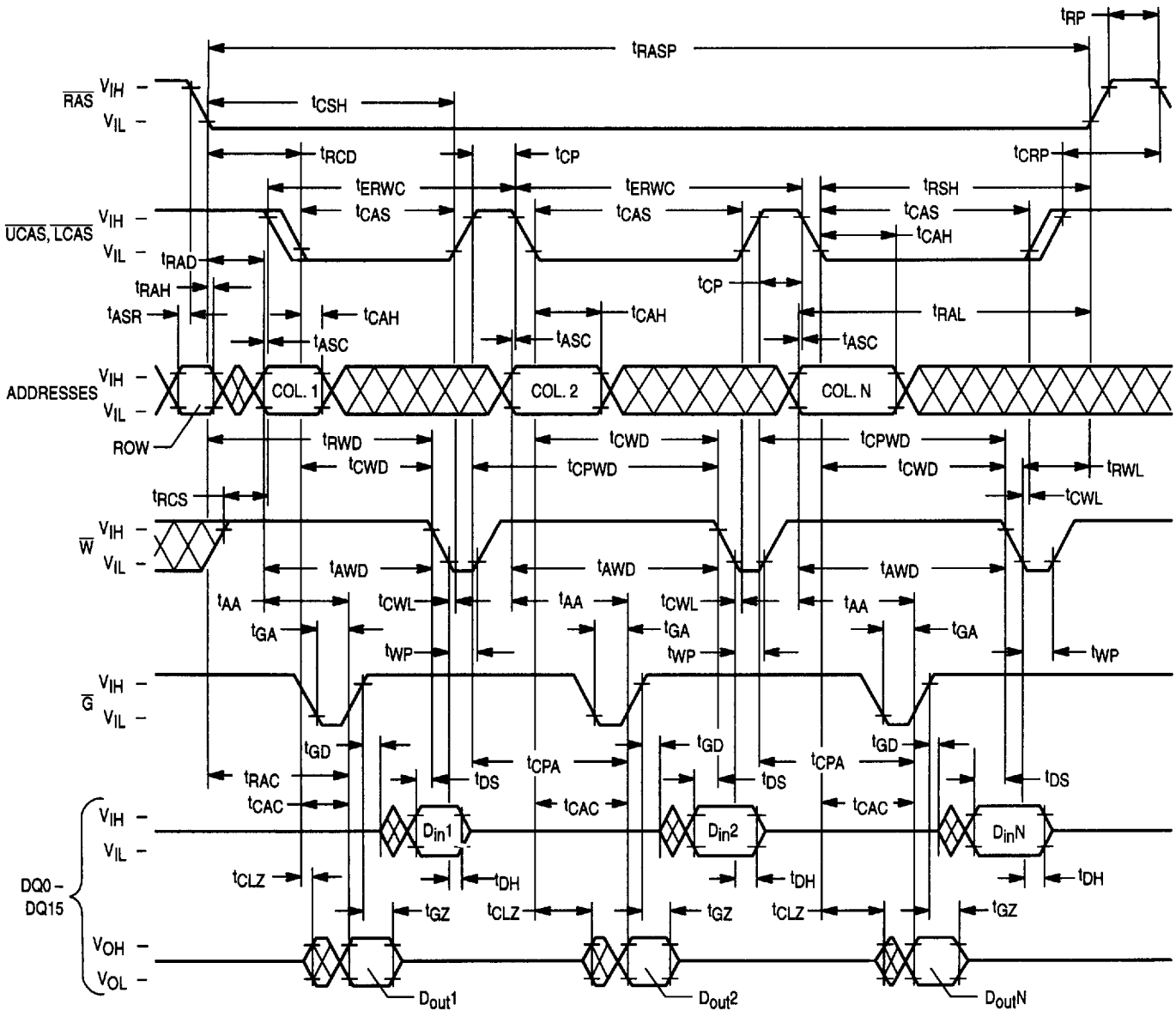
EXTENDED DATA OUT BYTE READ CYCLE



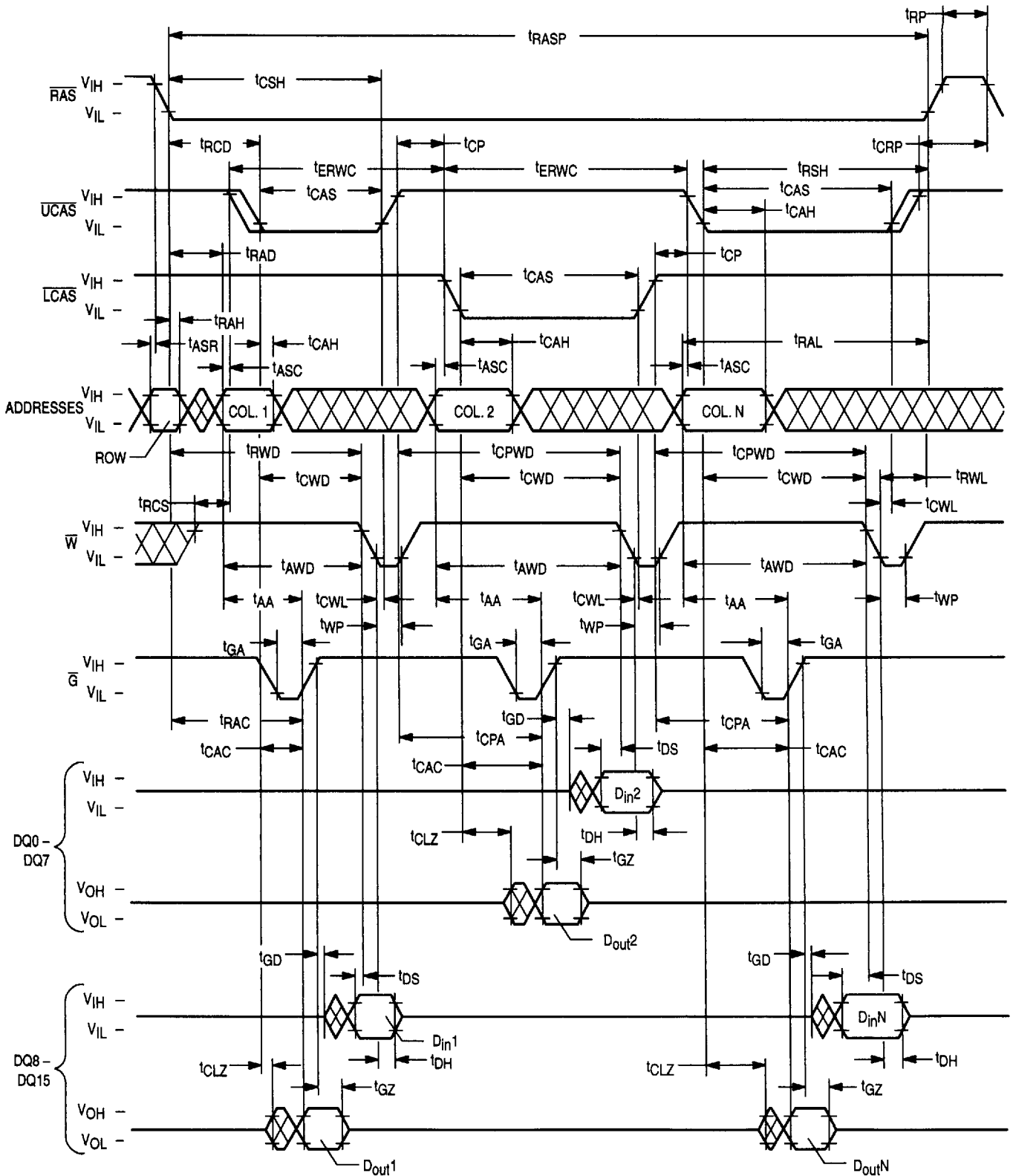
EXTENDED DATA OUT BYTE WRITE CYCLE (EARLY WRITE)



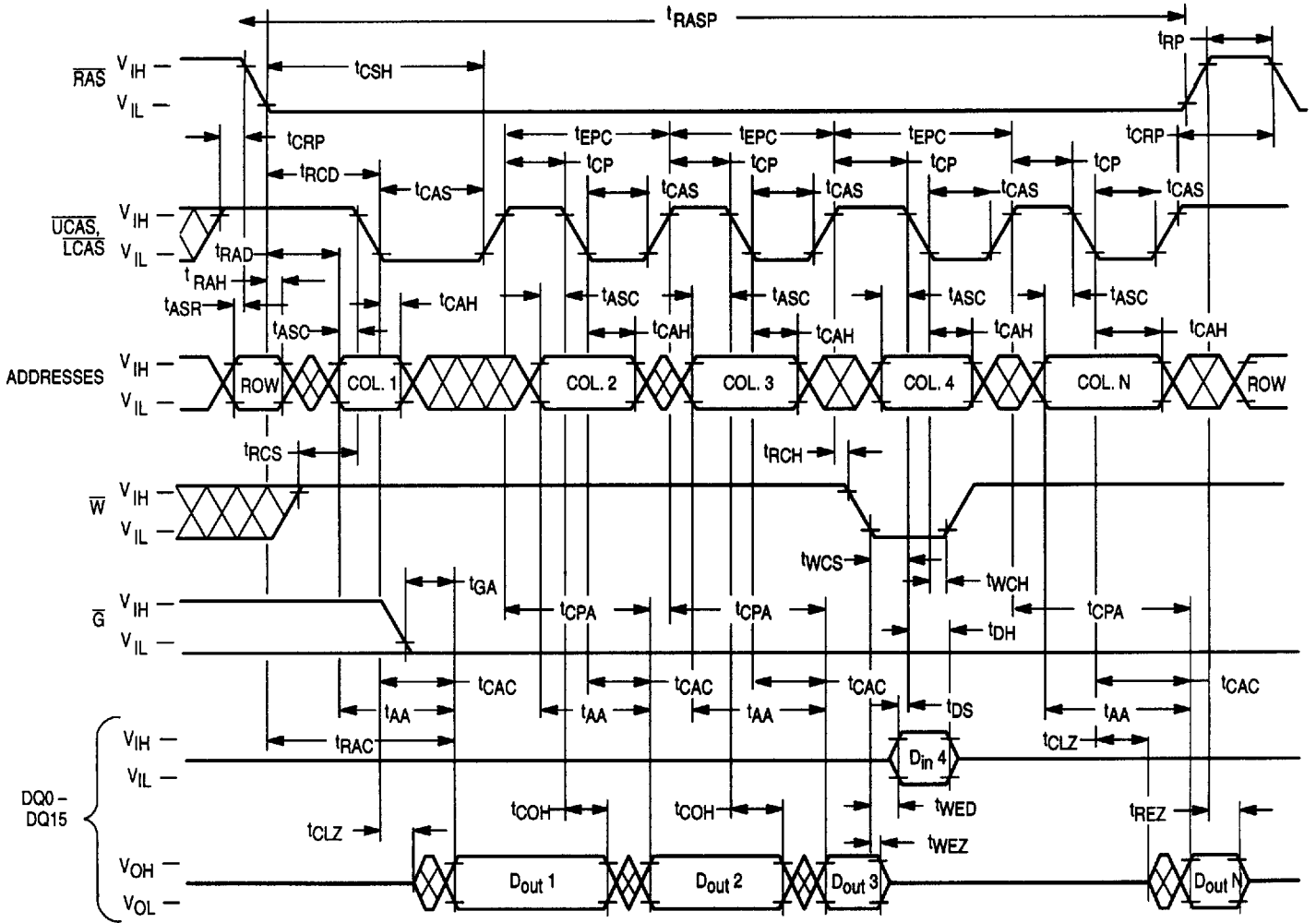
EXTENDED DATA OUT READ-WRITE CYCLE



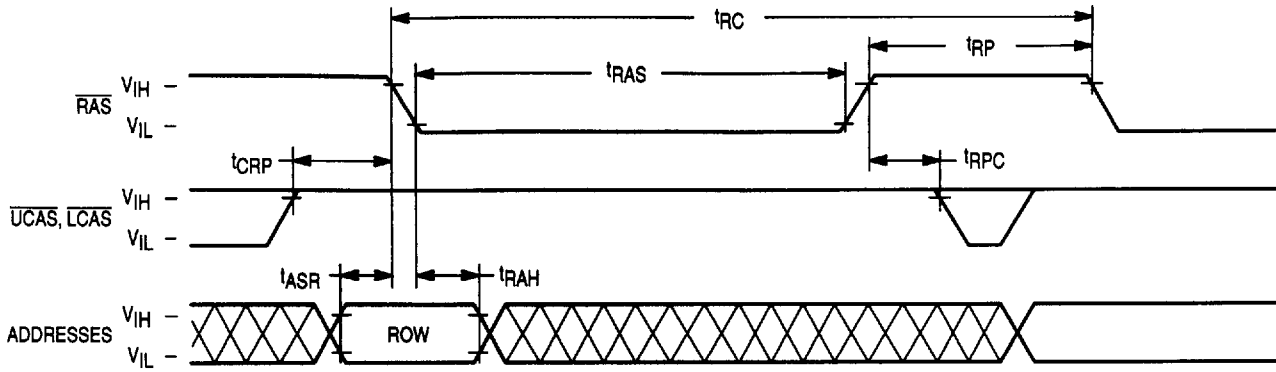
EXTENDED DATA OUT BYTE READ-WRITE CYCLE



EXTENDED DATA OUT READ WRITE MIXED CYCLE

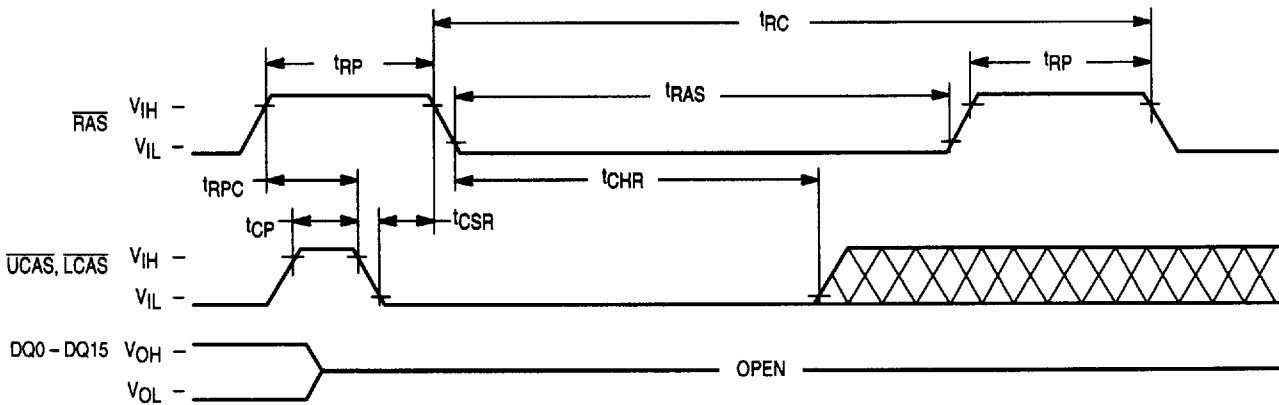


RAS-ONLY REFRESH CYCLE



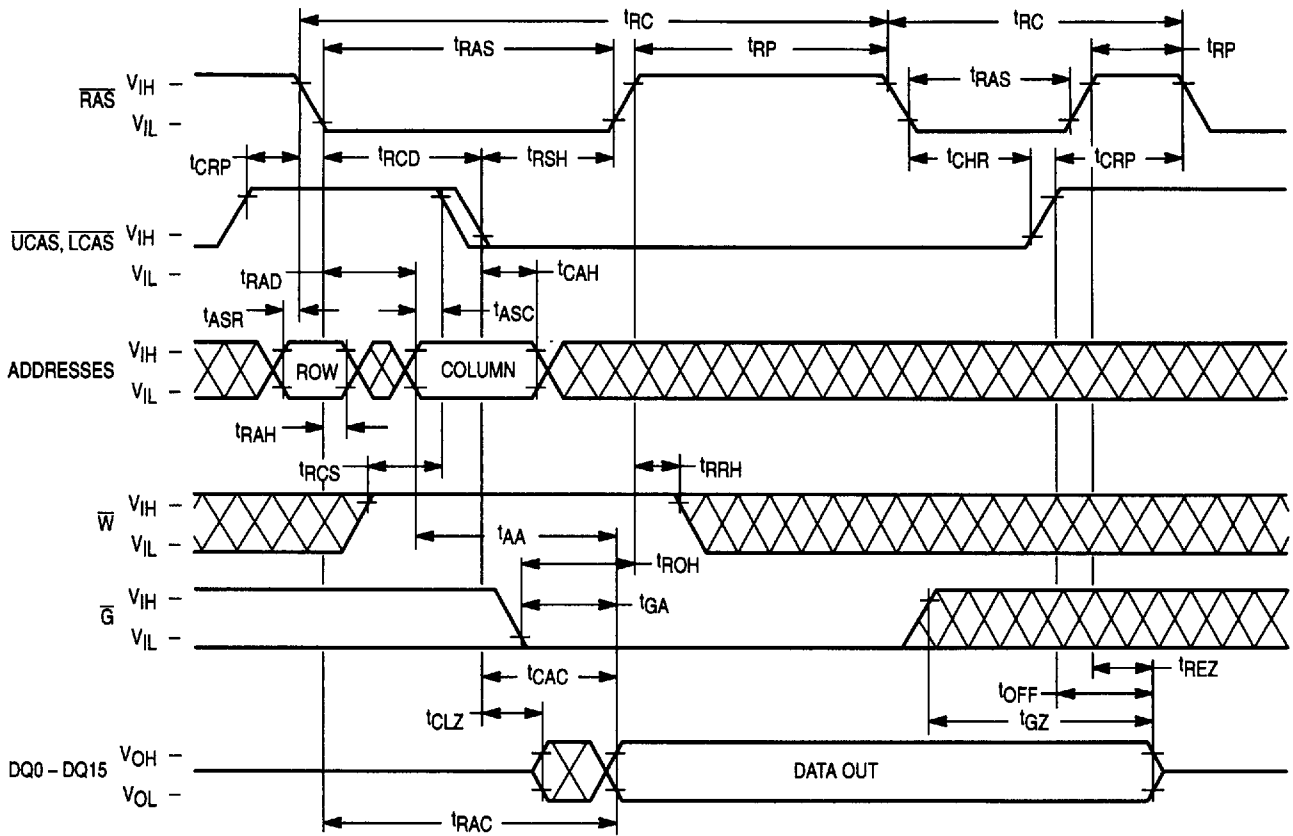
NOTE: $\overline{W}, \overline{G}$ = H or L
 DQ0 - DQ15 = Open
 Addresses: MCM516165BV — A0 to A11; MCM518165BV — A0 to A9.

CAS BEFORE RAS REFRESH CYCLE

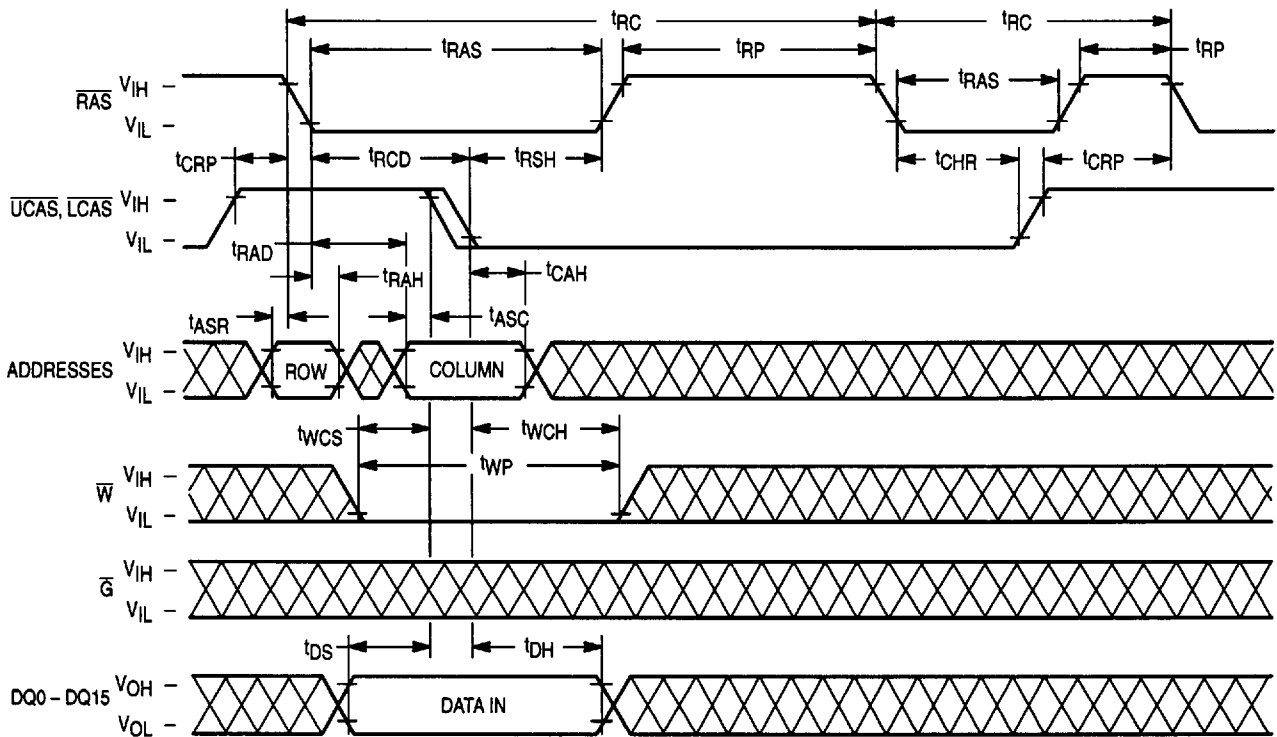


NOTE: $\overline{W}, \overline{G},$ Addresses = H or L
 \overline{CAS} before \overline{RAS} refresh is performed when either \overline{UCAS} or \overline{LCAS} meets this timing.

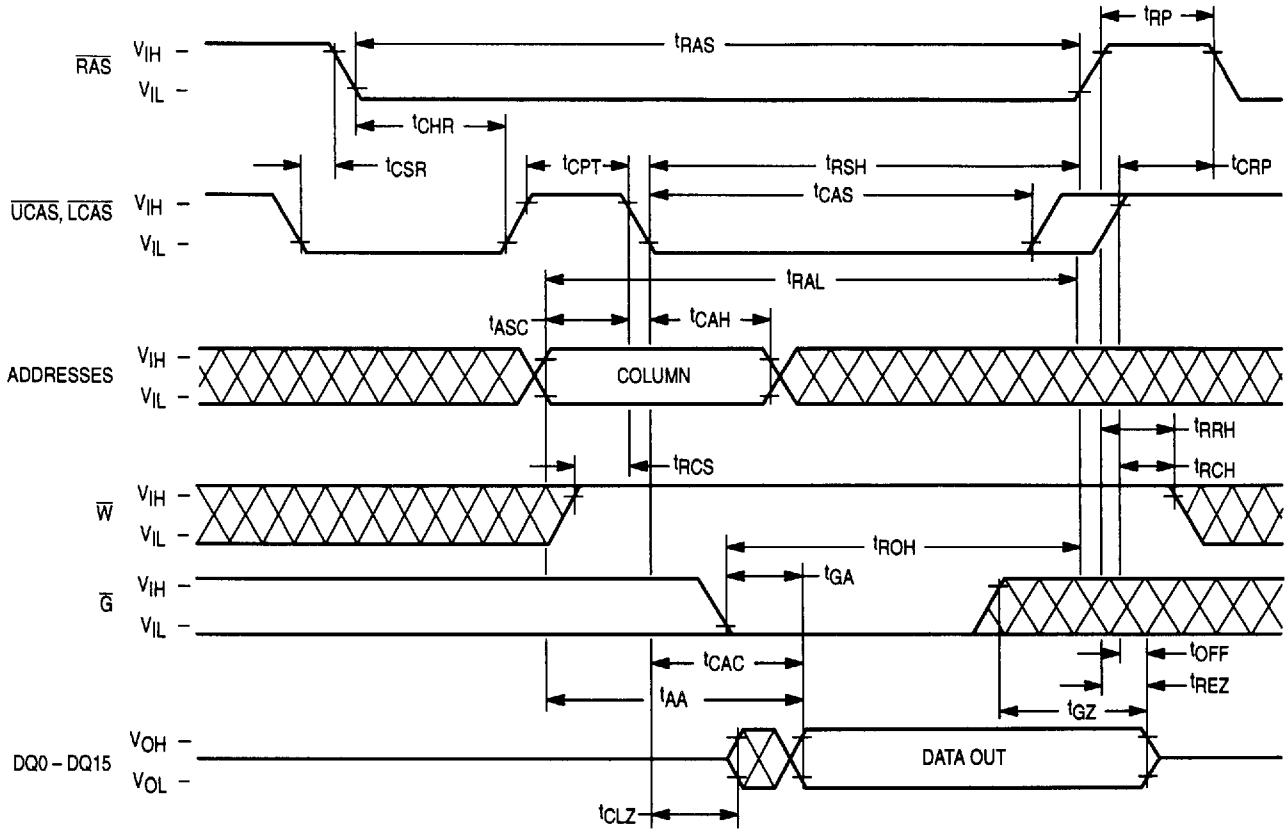
HIDDEN REFRESH CYCLE (READ)



HIDDEN REFRESH CYCLE (WRITE)

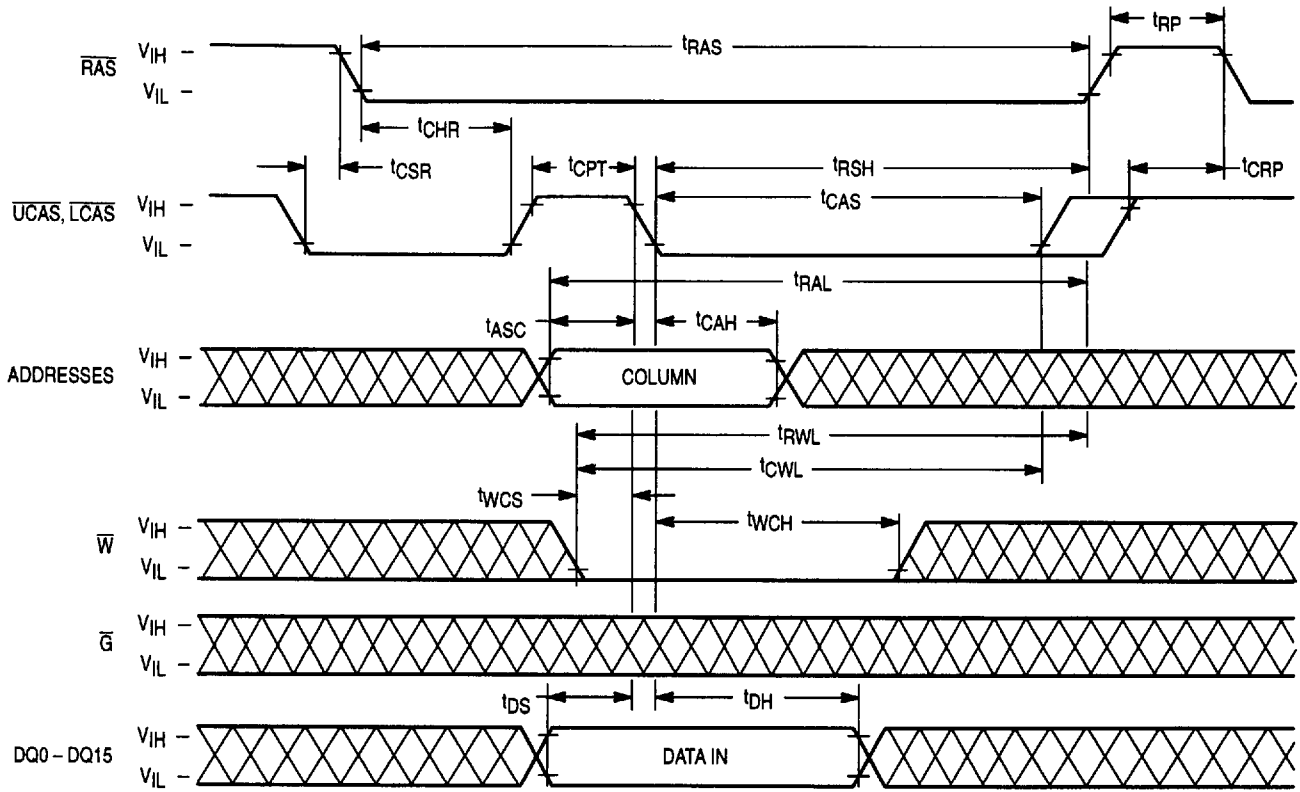


CAS BEFORE RAS REFRESH COUNTER TEST READ CYCLE



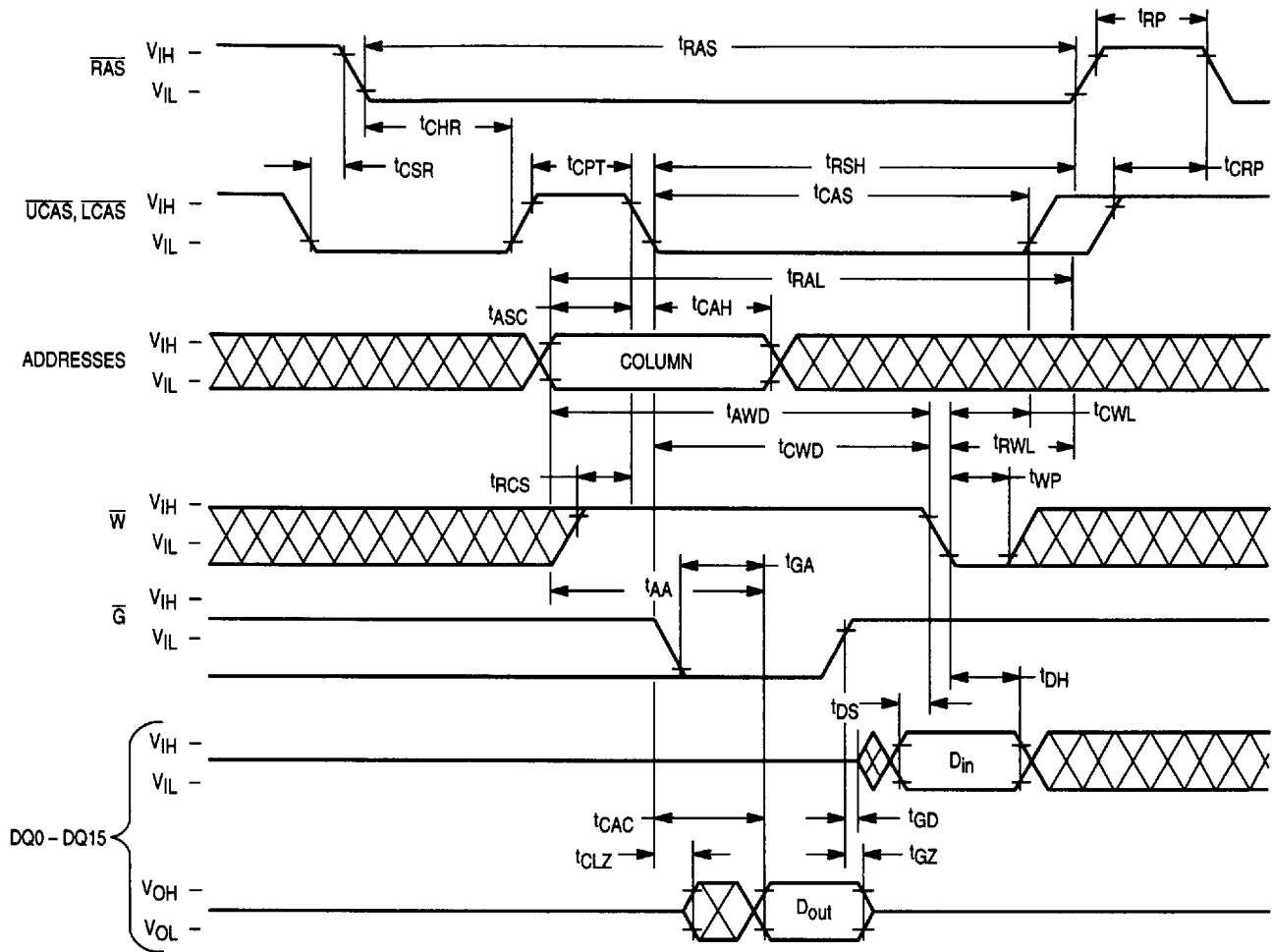
NOTE: Addresses: MCM516165BV — A0 to A7; MCM518165BV — A0 to A9

CAS BEFORE RAS REFRESH COUNTER TEST WRITE CYCLE



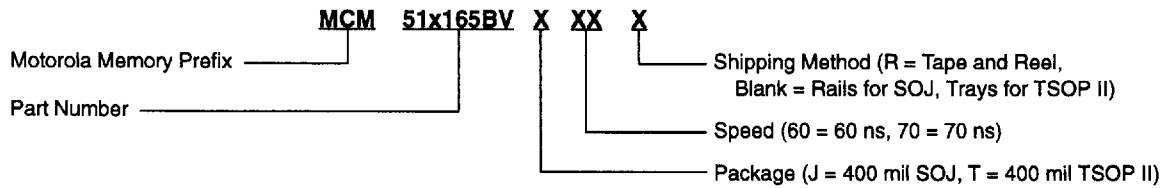
NOTE: Addresses: MCM516165BV — A0 to A7; MCM518165BV — A0 to A9

CAS BEFORE RAS REFRESH COUNTER TEST READ-WRITE CYCLE



NOTE: Addresses: MCM516165BV — A0 to A7; MCM518165BV — A0 to A9.

ORDERING INFORMATION
(Order by Full Part Number)

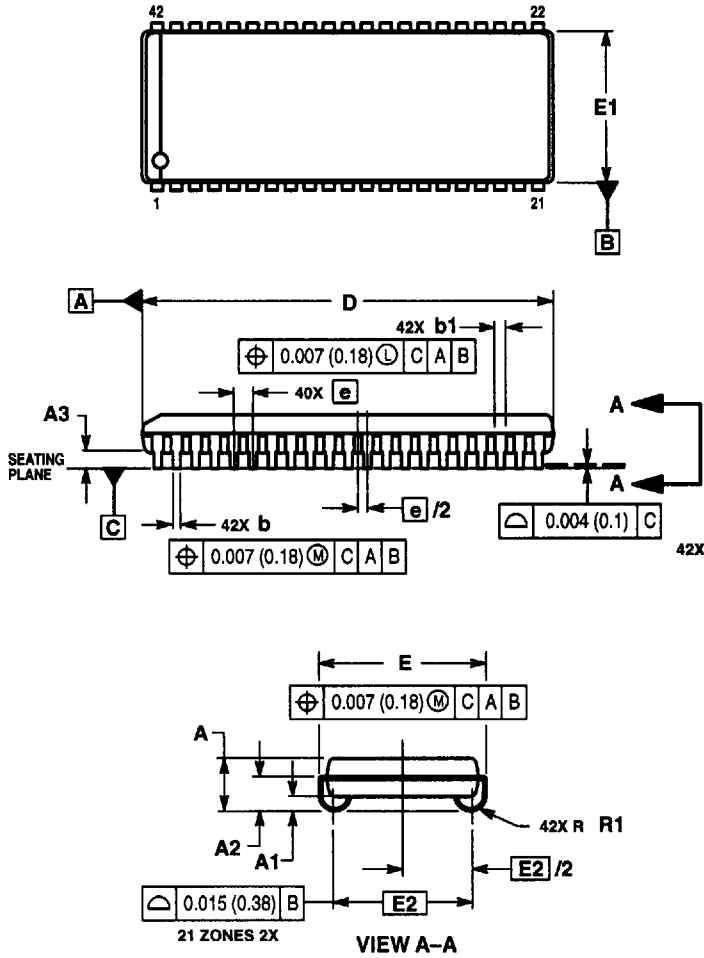


Full Part Numbers — MCM516165BVJ60 MCM516165BVJ60R MCM516165BVT60 MCM516165BVT60R
 MCM516165BVJ70 MCM516165BVJ70R MCM516165BVT70 MCM516165BVT70R

MCM518165BVJ60 MCM518165BVJ60R MCM518165BVT60 MCM518165BVT60R
 MCM518165BVJ70 MCM518165BVJ70R MCM518165BVT70 MCM518165BVT70R

PACKAGE DIMENSIONS

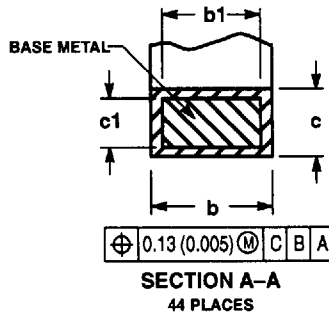
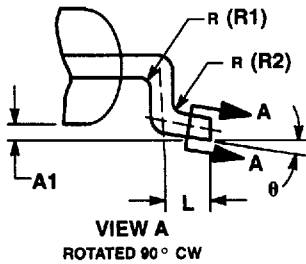
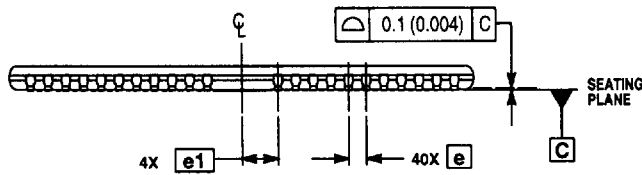
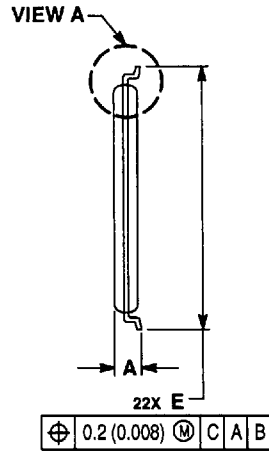
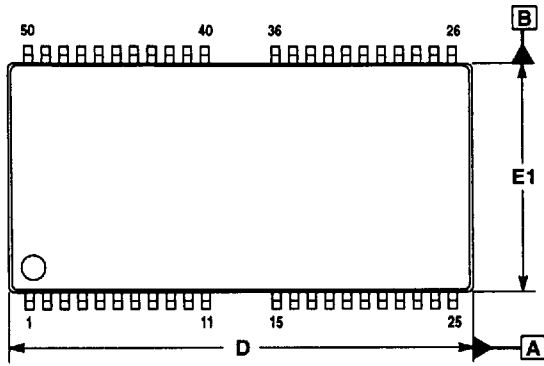
J PACKAGE
400 MIL SOJ
CASE 986A-01



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION D DOES NOT INCLUDE MOLD FLASH, TIE BAR BURRS AND GATE BURRS. MOLD FLASH, TIE BAR BURRS AND GATE BURRS SHALL NOT EXCEED 0.006 (0.15) PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010 (0.25) PER SIDE.
 4. THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM. DIMENSIONS D AND E1 AND, HENCE, DATUMS A AND B, ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
 5. DIMENSIONS b1 DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE SHOULDER WIDTH TO EXCEED b1 MAX BY MORE THAN 0.005 (0.13) THE DAMBAR INTRUSION(S) SHALL NOT REDUCE THE SHOULDER WIDTH TO LESS THAN 0.001 (0.03) BELOW b2 MIN

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.130	0.146	3.30	3.70
A1	0.031	0.047	0.80	1.20
A2	0.092	—	2.35	—
A3	0.031	—	0.80	—
b	0.016	0.020	0.41	0.50
b1	0.026	0.032	0.66	0.81
D	1.070	1.080	27.19	27.43
E	0.430	0.440	10.92	11.18
E1	0.395	0.405	10.03	10.29
E2	0.366	BSC	9.30	BSC
e	0.050	BSC	1.27	BSC
R1	0.025	0.035	0.63	0.89

T PACKAGE
400 MIL TSOP II
CASE 985A-01



NOTES

- 1 DIMENSIONS AND TOLERANCING PER ASME Y14 5M, 1994
- 2 CONTROLLING DIMENSION MM
- 3 DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION. MOLD PROTRUSION IS 0.15 (0.006) MAXIMUM PER SIDE
- 4 DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSIONS DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED 0.58 (0.023)
- 5 FOR LEAD IDENTIFICATION PURPOSES, PIN POSITIONS 12, 13, 14, 37, 38 AND 39 ARE NOT USED

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	—	1.20	—	0.047
A1	0.05	0.15	0.002	0.006
b	0.25	0.45	0.010	0.018
b1	0.25	0.40	0.010	0.016
c	0.12	0.25	0.005	0.010
c1	0.10	0.20	0.004	0.008
D	20.85	21.06	0.821	0.829
e	0.80 BSC		0.0315 BSC	
e1	1.60 BSC		0.063 BSC	
E	11.58	11.96	0.455	0.471
E1	10.06	10.26	0.396	0.404
L	0.40	0.60	0.016	0.024
R1	0.10 REF		0.004 REF	
R2	0.10 REF		0.004 REF	
θ	0°	10°	0°	10°

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