

- SIMM modules with 8 388 608 words by 36-bit organization for PC main memory applications
- Fast access and cycle time  
60 ns access time  
110 ns cycle time (-60 version)
- Fast page mode capability  
40 ns cycle time (-60 version)  
Single + 5 V ( $\pm 10\%$ ) supply
- Low power dissipation  
max. 7260 mW active (-60 version)  
max. 6600 mW active (-70 version)  
CMOS – 132 mW standby  
TTL – 264 mW standby
- $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh  
 $\overline{\text{RAS}}$ -only-refresh  
Hidden-refresh
- 24 decoupling capacitors mounted on substrate
- All inputs, outputs and clocks fully TTL compatible
- 72 pin Single in-Line Memory Module (L-SIM-72-14) with 31.75 mm height
- Utilizes sixteen 4Mx4-DRAMs and eight 4M x 1 DRAMs in 300 mil wide SOJ packages
- 2048 refresh cycles / 32 ms
- Optimized for use in byte-write parity applications
- Tin-Lead contact pads (S- version)
- Gold contact pads (GS - version)

The HYM 368020S/GS-60 is a 32 MByte DRAM module organized as 8 388 608 words by 36-Bit in a 72-pin single-in-line package comprising sixteen HYB 5117400BJ 4M × 4 DRAMs and eight HYB 514100BJ 4M x 1 DRAMs in 300 mil wide SOJ-packages mounted together with 24 0.2 μF ceramic decoupling capacitors on a PC board.

The HYM 368020S/GS-60 can also be used as a 16 777 360 words by 18-bits dynamic RAM module by means of connecting DQ0 and DQ18, DQ1 and DQ19, DQ2 and DQ20, ... , DQ17 and DQ35, respectively.

Each HYB 5117400BJ and HYB 514100BJ is described in the data sheet and is fully electrical tested and processed according to SIEMENS standard quality procedure prior to module assembly. After assembly onto the board, a further set of electrical tests is performed.

The speed of the module can be detected by the use of four presence detect pins.

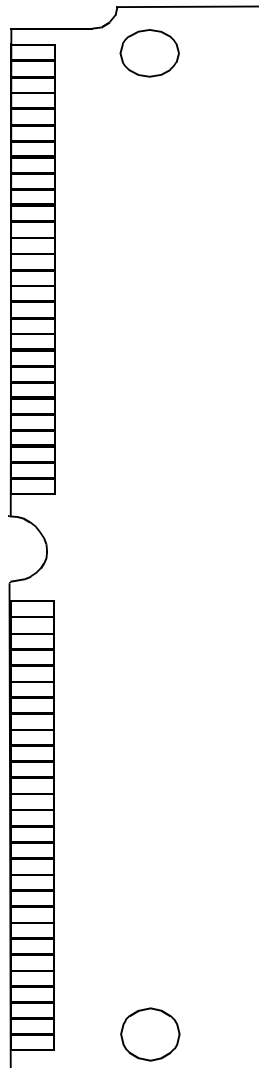
The common I/O feature on the HYM 368020S/GS-60/-70 dictates the use of early write cycles.

### Ordering Information

Type	Ordering Code	Package	Description
HYM 368020S-60	Q67100-Q985	L-SIM-72-14	DRAM Module (access time 60 ns)
HYM 368020GS-60	Q67100-Q2007	L-SIM-72-14	DRAM Module (access time 60 ns)

## Pin Configuration

VSS	1	DQ0	2
DQ18	3	DQ1	4
DQ19	5	DQ2	6
DQ20	7	DQ3	8
DQ21	9	VCC	10
N.C.	11	A0	12
A1	13	A2	14
A3	15	A4	16
A5	17	A6	18
A10	19	DQ4	20
DQ22	21	DQ5	22
DQ23	23	DQ6	24
DQ24	25	DQ7	26
DQ25	27	A7	28
N.C.	29	VCC	30
A8	31	A9	32
$\overline{\text{RAS3}}$	33	$\overline{\text{RAS2}}$	34
DQ26	35	DQ8	36
DQ17	37	DQ35	38
VSS	39	$\overline{\text{CAS0}}$	40
$\overline{\text{CAS2}}$	41	$\overline{\text{CAS3}}$	42
$\overline{\text{CAS1}}$	43	$\overline{\text{RAS0}}$	44
$\overline{\text{RAS1}}$	45	N.C.	46
$\overline{\text{WE}}$	47	N.C.	48
DQ9	49	DQ27	50
DQ10	51	DQ28	52
DQ11	53	DQ29	54
DQ12	55	DQ30	56
DQ13	57	DQ31	58
VCC	59	DQ32	60
DQ14	61	DQ33	62
DQ15	63	DQ34	64
DQ16	65	N.C.	66
PD0	67	PD1	68
PD2	69	PD3	70
N.C.	71	VSS	72

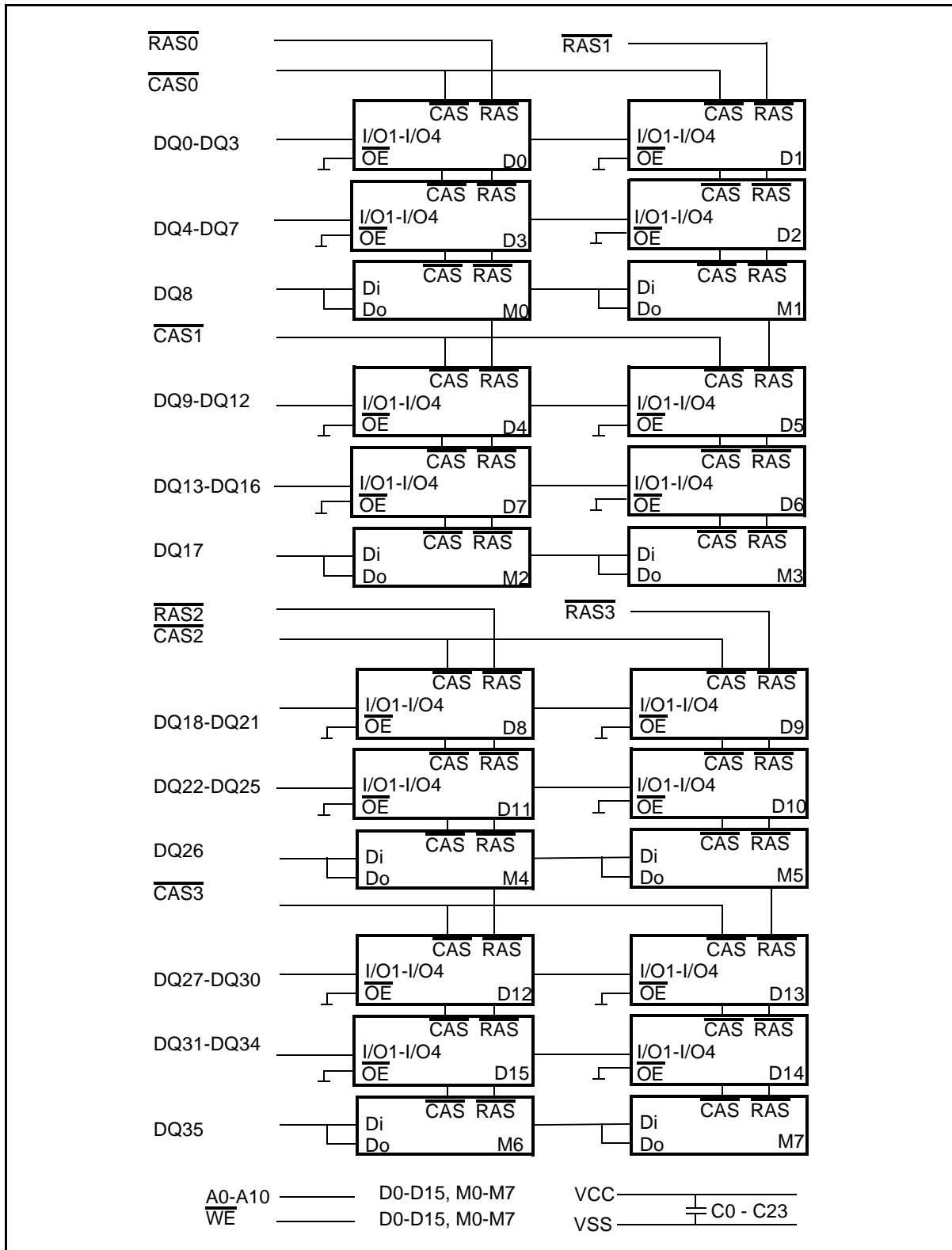


## Pin Names

A0-A10	Address Inputs
DQ0-DQ35	Data Input/Output
$\overline{\text{CAS0}}$ - $\overline{\text{CAS3}}$	Column Address Strobe
$\overline{\text{RAS0}}$ - $\overline{\text{RAS3}}$	Row Address Strobe
$\overline{\text{WE}}$	Read/Write Input
$V_{CC}$	Power (+ 5 V)
$V_{SS}$	Ground
PD	Presence Detect Pin
N.C.	No Connection

## Presence Detect Pins

	-60
PD0	N.C.
PD1	$V_{SS}$
PD2	N.C.
PD3	N.C.



### Absolute Maximum Ratings

Operation temperature range .....	0 to + 70 °C
Storage temperature range.....	- 55 to 125 °C
Input/output voltage .....	-0.5V to min (V <sub>CC</sub> +0.5, 7.0) V
Power supply voltage.....	- 1 to + 7 V
Power dissipation.....	9.24 W
Data out current (short circuit) .....	50 mA

**Note:** Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage of the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### DC Characteristics

T<sub>A</sub> = 0 to 70 °C, V<sub>CC</sub> = 5 V ± 10 %

Parameter	Symbol	Limit Values		Unit	Test Condition
		min.	max.		
Input high voltage	V <sub>IH</sub>	2.4	V <sub>CC</sub> +0.5	V	1)
Input low voltage	V <sub>IL</sub>	- 0.5	0.8	V	1)
Output high voltage (I <sub>OUT</sub> = - 5 mA)	V <sub>OH</sub>	2.4	-	V	1)
Output low voltage (I <sub>OUT</sub> = 4.2 mA)	V <sub>OL</sub>	-	0.4	V	1)
Input leakage current (0 V < V <sub>IN</sub> < 6.5 V, all other pins = 0 V)	I <sub>I(L)</sub>	- 20	20	μA	1)
Output leakage current (DO is disabled, 0 V < V <sub>OUT</sub> < 5.5 V)	I <sub>O(L)</sub>	- 20	20	μA	1)
Average V <sub>CC</sub> supply current ( $\overline{RAS}$ , $\overline{CAS}$ , address cycling, t <sub>RC</sub> = t <sub>RC</sub> min) -60 version	I <sub>CC1</sub>	-	1320	mA	2),3),4)
Standby V <sub>CC</sub> supply current ( $\overline{RAS} = \overline{CAS} = V_{IH}$ )	I <sub>CC2</sub>	-	48	mA	
Average V <sub>CC</sub> supply current during $\overline{RAS}$ only refresh cycles ( $\overline{RAS}$ cycling, $\overline{CAS} = V_{IH}$ , t <sub>RC</sub> = t <sub>RC</sub> min) -60 version	I <sub>CC3</sub>	-	1320	mA	2),4)

## DC Characteristics<sup>1)</sup> (cont'd)

Parameter	Symbol	Limit Values		Unit	Test Condition
		min.	max.		
Average $V_{CC}$ supply current during fast page mode ( $\overline{RAS} = V_{IL}$ , $\overline{CAS}$ , address cycling, $t_{PC} = t_{PC \text{ min}}$ ) -60 version	$I_{CC4}$	–	920	mA	2),3),4)
Standby $V_{CC}$ supply current ( $\overline{RAS} = \overline{CAS} = V_{CC} - 0.2 \text{ V}$ )	$I_{CC5}$	–	24	mA	
Average $V_{CC}$ supply current during $\overline{CAS}$ -before- $\overline{RAS}$ refresh mode ( $\overline{RAS}$ , $\overline{CAS}$ cycling, $t_{RC} = t_{RC \text{ min}}$ ) -60 version	$I_{CC6}$	–	1320	mA	2),4)

## Capacitance

$T_A = 0 \text{ to } 70 \text{ }^\circ\text{C}$ ,  $V_{CC} = 5 \text{ V} \pm 10 \%$ ,  $f = 1 \text{ MHz}$

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Input capacitance (A0 to A10, $\overline{WE}$ )	$C_{11}$	–	180	pF
Input capacitance ( $\overline{RAS0} - \overline{RAS3}$ )	$C_{12}$	–	50	pF
Input capacitance ( $\overline{CAS0} - \overline{CAS3}$ )	$C_{13}$	–	40	pF
I/O capacitance (DQ0-DQ35)	$C_{10}$	–	25	pF

**AC Characteristics** <sup>5)6)</sup>

$T_A = 0$  to  $70$  °C,  $V_{CC} = 5$  V ± 10 %,  $t_T = 5$  ns

Parameter	Symbol	Limit Values		Unit	Note
		-60			
		min.	max.		

**common parameters**

Random read or write cycle time	$t_{RC}$	110	–	ns	
$\overline{RAS}$ precharge time	$t_{RP}$	40	–	ns	
$\overline{RAS}$ pulse width	$t_{RAS}$	60	10k	ns	
$\overline{CAS}$ pulse width	$t_{CAS}$	15	10k	ns	
Row address setup time	$t_{ASR}$	0	–	ns	
Row address hold time	$t_{RAH}$	10	–	ns	
Column address setup time	$t_{ASC}$	0	–	ns	
Column address hold time	$t_{CAH}$	15	–	ns	
$\overline{RAS}$ to $\overline{CAS}$ delay time	$t_{RCD}$	20	45		
$\overline{RAS}$ to column address delay time	$t_{RAD}$	15	30	ns	
$\overline{RAS}$ hold time	$t_{RSH}$	15	–	ns	
$\overline{CAS}$ hold time	$t_{CSH}$	60	–	ns	
$\overline{CAS}$ to $\overline{RAS}$ precharge time	$t_{CRP}$	5	–	ns	
Transition time (rise and fall)	$t_T$	3	50	ns	7
Refresh period	$t_{REF}$	–	32	ms	

**Read Cycle**

Access time from $\overline{RAS}$	$t_{RAC}$	–	60	ns	8, 9
Access time from $\overline{CAS}$	$t_{CAC}$	–	15	ns	8, 9
Access time from column address	$t_{AA}$	–	30	ns	8,10
Column address to $\overline{RAS}$ lead time	$t_{RAL}$	30	–	ns	
Read command setup time	$t_{RCS}$	0	–	ns	
Read command hold time	$t_{RCH}$	0	–	ns	11
Read command hold time referenced to $\overline{RAS}$	$t_{RRH}$	0	–	ns	11
$\overline{CAS}$ to output in low-Z	$t_{CLZ}$	0	–	ns	8
Output buffer turn-off delay	$t_{OFF}$	0	15	ns	12

### AC Characteristics (cont'd) <sup>5)6)</sup>

$T_A = 0$  to  $70$  °C,  $V_{CC} = 5$  V  $\pm$  10 %,  $t_T = 5$  ns

Parameter	Symbol	Limit Values		Unit	Note
		-60			
		min.	max.		

#### **Early Write Cycle**

Write command hold time	$t_{WCH}$	10	–	ns	
Write command pulse width	$t_{WP}$	10	–	ns	
Write command setup time	$t_{WCS}$	0	–	ns	13
Write command to $\overline{RAS}$ lead time	$t_{RWL}$	15	–	ns	
Write command to $\overline{CAS}$ lead time	$t_{CWL}$	15	–	ns	
Data setup time	$t_{DS}$	0	–	ns	14
Data hold time	$t_{DH}$	10	–	ns	14

#### **Fast Page Mode Cycle**

Fast page mode cycle time	$t_{PC}$	40	–	ns	
$\overline{CAS}$ precharge time	$t_{CP}$	10	–	ns	
Access time from $\overline{CAS}$ precharge	$t_{CPA}$	–	35	ns	7
$\overline{RAS}$ pulse width	$t_{RAS}$	60	200k	ns	
$\overline{CAS}$ precharge to $\overline{RAS}$ Delay	$t_{RHCP}$	35	–	ns	

#### **$\overline{CAS}$ -before- $\overline{RAS}$ Refresh Cycle**

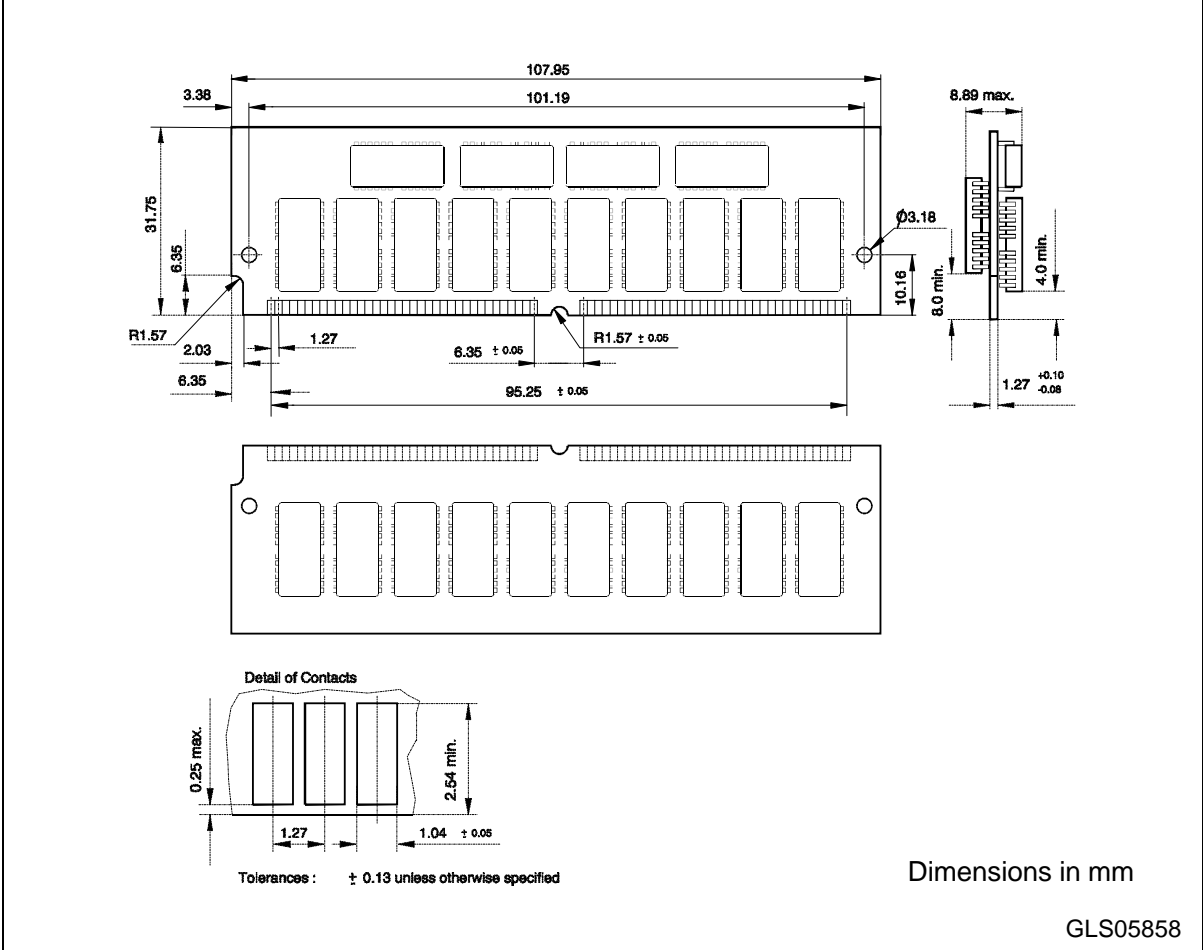
$\overline{CAS}$ setup time	$t_{CSR}$	10	–	ns	
$\overline{CAS}$ hold time	$t_{CHR}$	10	–	ns	
$\overline{RAS}$ to $\overline{CAS}$ precharge time	$t_{RPC}$	5	–	ns	
Write to $\overline{RAS}$ precharge time	$t_{WRP}$	10	–	ns	
Write hold time referenced to $\overline{RAS}$	$t_{WRH}$	10	–	ns	



### Notes:

- 1) All voltages are referenced to VSS.
- 2) ICC1, ICC3, ICC4 and ICC6 depend on cycle rate.
- 3) ICC1 and ICC4 depend on output loading. Specified values are measured with the output open.
- 4) Address can be changed once or less while  $\overline{\text{RAS}} = \text{VIL}$ . In the case of ICC4 it can be changed once or less during a fast page mode cycle (tPC).
- 5) An initial pause of 200  $\mu\text{s}$  is required after power-up followed by 8  $\overline{\text{RAS}}$  cycles of which at least one cycle has to be a refresh cycle, before proper device operation is achieved. In case of using internal refresh counter, a minimum of 8  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  initialization cycles instead of 8  $\overline{\text{RAS}}$  cycles are required.
- 6) AC measurements assume  $t_T = 5 \text{ ns}$ .
- 7)  $V_{IH}$  (min.) and  $V_{IL}$  (max.) are reference levels for measuring timing of input signals. Transition times are also measured between  $V_{IH}$  and  $V_{IL}$ .
- 8) Measured with a load equivalent to 2 TTL loads and 100 pF.
- 9) Operation within the  $t_{\text{RCD}}$  (max.) limit ensures that  $t_{\text{RAC}}$  (max.) can be met.  $t_{\text{RCD}}$  (max.) is specified as a reference point only: If  $t_{\text{RCD}}$  is greater than the specified  $t_{\text{RCD}}$  (max.) limit, then access time is controlled by  $t_{\text{CAC}}$ .
- 10) Operation within the  $t_{\text{RAD}}$  (max.) limit ensures that  $t_{\text{RAC}}$  (max.) can be met.  $t_{\text{RAD}}$  (max.) is specified as a reference point only: If  $t_{\text{RAD}}$  is greater than the specified  $t_{\text{RAD}}$  (max.) limit, then access time is controlled by  $t_{\text{AA}}$ .
- 11) Either  $t_{\text{RCH}}$  or  $t_{\text{RRH}}$  must be satisfied for a read cycle.
- 12)  $t_{\text{OFF}}$  (max.) define the time at which the outputs achieve the open-circuit condition and are not referenced to output voltage levels.
- 13)  $t_{\text{WCS}}$  is not a restrictive operating parameter. This is included in the data sheet as electrical characteristics only. If  $t_{\text{WCS}} > t_{\text{WCS}}(\text{min.})$ , the cycle is an early write cycle and the I/O pin will remain open-circuit (high impedance) through the entire cycle.
- 14) These parameters are referenced to the  $\overline{\text{CAS}}$  leading edge.

Package Outline



Module Package, L-SIM-72-14  
(Single in-Line Memory Module)