SIEMENS

2M x 32-Bit Dynamic RAM Module HYM 322160S/GS-60/-70

Advanced Information

- 2 097 152 words by 32-Bit organization (alternative 4 194 304 words by 16-Bit)
- Fast access and cycle time
  60 ns access time
  110 ns cycle time (-60 version)
  70 ns access time
  130 ns cycle time (-70 version)
- Fast page mode capability with
  40 ns cycle time (-60 version)
  45 ns cycle time (-70 version)
- Single + 5 V (± 10 %) supply
- Low power dissipation
  max. 4840 mW active (-60 version)
  max. 4400 mW active (-70 version)
  CMOS – 88 mW standby
  TTL – 176 mW standby
- $\overline{\text{CAS}}$-before-$\overline{\text{RAS}}$ refresh
  $\overline{\text{RAS}}$-only-refresh
  Hidden-refresh
- 8 decoupling capacitors mounted on substrate
- All inputs, outputs and clocks fully TTL compatible
- 72 pin double-sided Single in-Line Memory Module with 25.4 mm (1000 mil) height
- Utilizes sixteen 1M × 4 DRAMs in 300 mil SOJ packages
- 1024 refresh cycles / 16 ms
- Optimized for use in byte-write non-parity applications
- Tin-Lead contact pads (S- version)
- Gold contact pads (GS - version)

The HYM322160S/GS-60/-70 is a 8 MByte DRAM module organized as 2 097 152 words by 32-Bit in a 72-pin single-in-line package comprising sixteen HYB514400BJ 1M × 4 DRAMs in 300 mil wide SOJ-packages mounted together with eight 0.2 µF ceramic decoupling capacitors on a PC board.

The HYM322160S/GS-60/-70 can also be used as a 4 194 304 words by 16-Bits dynamic RAM module by means of connecting DQ0 and DQ16, DQ1 and DQ17, DQ2 and DQ18, …, DQ15 and DQ31, respectively.

Each HYB514400BJ 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.

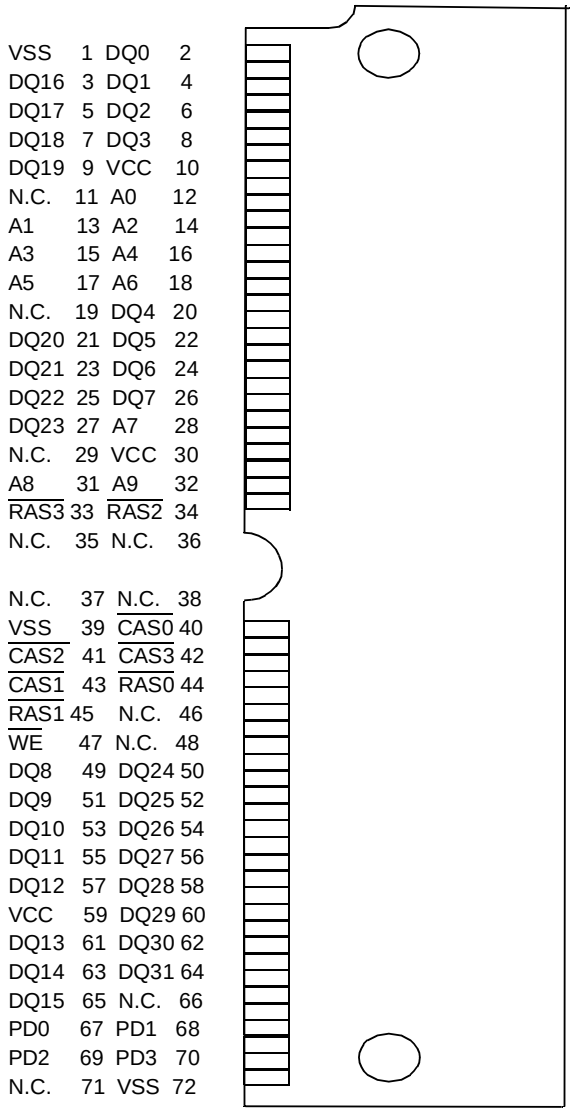
The speed of the module can be detected by the use of four presence detect pins.

The common I/O feature on the HYM 322160S/GS-60/-70 dictates the use of early write cycles.

Ordering Information

Type	Ordering Code	Package	Description
HYM 322160S-60	Q67100-Q2014	L-SIM-72-11	DRAM Module (access time 60 ns)
HYM 322160S-70	Q67100-Q2015	L-SIM-72-11	DRAM Module (access time 70 ns)
HYM 322160GS-60	Q67100-Q2016	L-SIM-72-11	DRAM Module (access time 60 ns)
HYM 322160GS-70	Q67100-Q2017	L-SIM-72-11	DRAM Module (access time 70 ns)

Pin Configuration



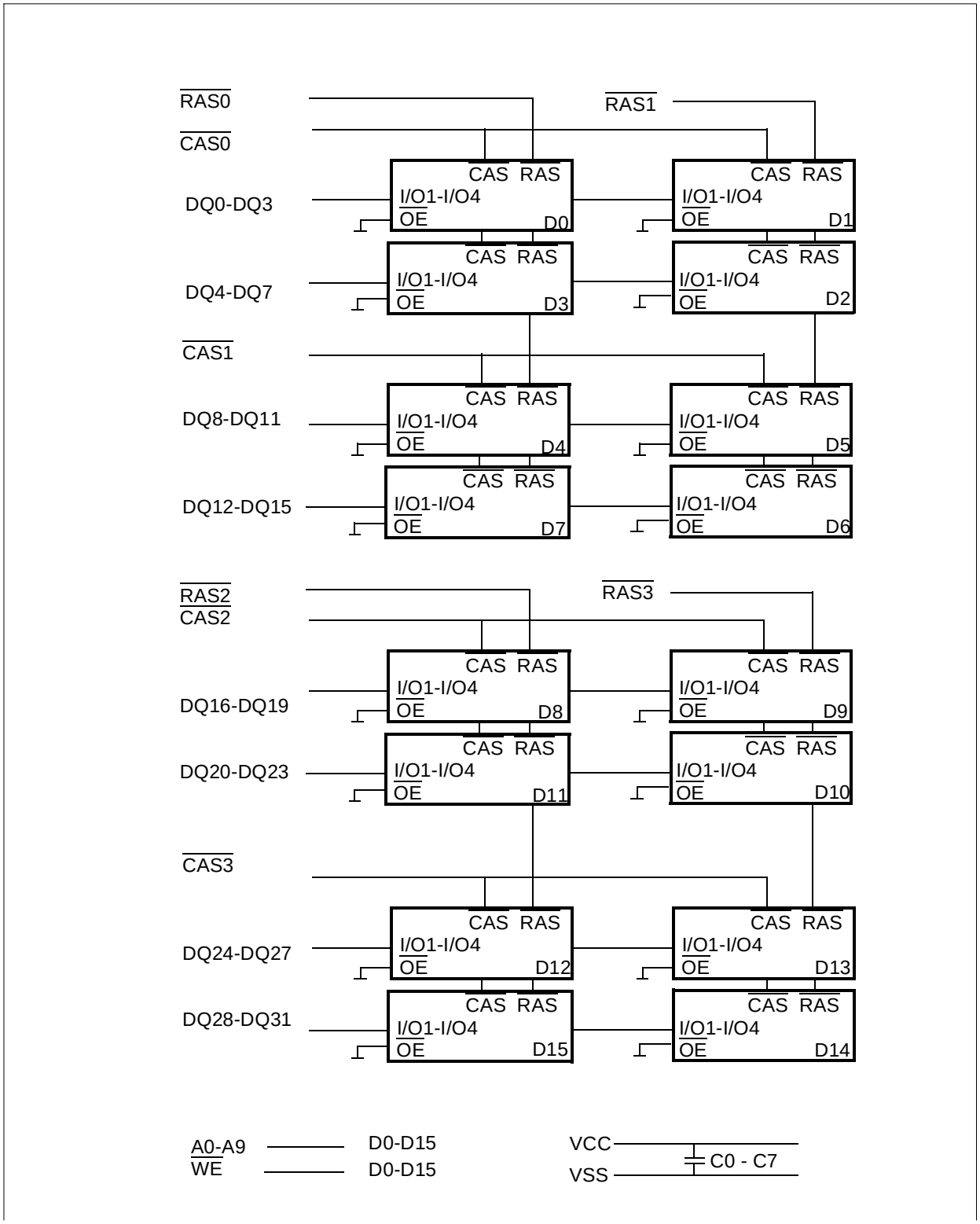
VSS	1	DQ0	2
DQ16	3	DQ1	4
DQ17	5	DQ2	6
DQ18	7	DQ3	8
DQ19	9	VCC	10
N.C.	11	A0	12
A1	13	A2	14
A3	15	A4	16
A5	17	A6	18
N.C.	19	DQ4	20
DQ20	21	DQ5	22
DQ21	23	DQ6	24
DQ22	25	DQ7	26
DQ23	27	A7	28
N.C.	29	VCC	30
A8	31	A9	32
$\overline{RAS3}$	33	$\overline{RAS2}$	34
N.C.	35	N.C.	36
N.C.	37	N.C.	38
VSS	39	$\overline{CAS0}$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

Pin Names

A0-A9	Address Inputs
DQ0-DQ31	Data Input/Output
$\overline{CAS0}$ - $\overline{CAS3}$	Column Address Strobe
$\overline{RAS0}$ - $\overline{RAS3}$	Row Address Strobe
$\overline{WE}$	Read/Write Input
V_{CC}	Power (+ 5 V)
V_{SS}	Ground
PD	Presence Detect Pin
N.C.	No Connection

Presence Detect Pins

	-60	-70
PD0	N.C.	N.C.
PD1	N.C.	N.C.
PD2	N.C.	V_{SS}
PD3	N.C.	N.C.



Block Diagram

Absolute Maximum Ratings

Operation temperature range ..... 0 to + 70 ℃
Storage temperature range..... – 55 to 125 ℃
Input/output voltage ..... – 1 to + 7 V
Power supply voltage..... – 1 to + 7 V
Power dissipation..... 6.2 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[1)]
T_A = 0 to 70 ℃, V_{CC} = 5 V ± 10 %

Parameter	Symbol	Limit Values		Unit	Test Condition
		min.	max.		
Input high voltage	V_{IH}	2.4	5.5	V	
Input low voltage	V_{IL}	– 1.0	0.8	V	
Output high voltage (I_{OUT} = – 5 mA)	V_{OH}	2.4	–	V	
Output low voltage (I_{OUT} = 4.2 mA)	V_{OL}	–	0.4	V	
Input leakage current (0 V < V_{IN} < 6.5 V, all other pins = 0 V)	$I_{I(L)}$	– 20	20	µA	
Output leakage current (DO is disabled, 0 V < V_{OUT} < 5.5 V)	$I_{O(L)}$	– 20	20	µA	
Average V_{CC} supply current ($\overline{RAS}$, $\overline{CAS}$, address cycling, t_{RC} = t_{RC} min) -60 version -70 version	I_{CC1}	 – –	 880 800	 mA mA	 2), 3)
Standby V_{CC} supply current ($\overline{RAS}$ = $\overline{CAS}$ = V_{IH})	I_{CC2}	–	32	mA	
Average V_{CC} supply current during $\overline{RAS}$ only refresh cycles ($\overline{RAS}$ cycling, $\overline{CAS}$ = V_{IH}, t_{RC} = t_{RC} min) -60 version -70 version	I_{CC3}	 – –	 880 800	 mA mA	 2)

DC Characteristics[1] (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} min)	I_{CC4}				
-60 version		–	560	mA	[2],
-70 version		–	560	mA	[3]
Standby V_{CC} supply current ($\overline{RAS}$ = $\overline{CAS}$ = V_{CC} – 0.2 V)	I_{CC5}	–	16	mA	
Average V_{CC} supply current during $\overline{CAS}$-before-$\overline{RAS}$ refresh mode ($\overline{RAS}$, $\overline{CAS}$ cycling, t_{RC} = t_{RC} min)	I_{CC6}				
-60 version		–	880	mA	[2]
-70 version		–	800	mA	

Capacitance
T_A = 0 to 70 °C, V_{CC} = 5 V ± 10 %, f = 1 MHz

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Input capacitance (A0 to A9, $\overline{WE}$)	C_{I1}	–	120	pF
Input capacitance ($\overline{RAS0}$-$\overline{RAS2}$, $\overline{CAS0}$-$\overline{CAS3}$)	C_{I2}	–	40	pF
I/O capacitance (DQ0-DQ31)	C_{IO1}	–	29	pF

AC Characteristics [5)6)] M16F

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

Parameter	Symbol	Limit Values				Unit	Note
		-50		-60			
		min.	max.	min.	max.		
common parameters							
Random read or write cycle time	t_{RC}	90	–	110	–	ns	
$\overline{RAS}$ precharge time	t_{RP}	30	–	40	–	ns	
$\overline{RAS}$ pulse width	t_{RAS}	50	10k	60	10k	ns	
$\overline{CAS}$ pulse width	t_{CAS}	13	10k	15	10k	ns	
Row address setup time	t_{ASR}	0	–	0	–	ns	
Row address hold time	t_{RAH}	8	–	10	–	ns	
Column address setup time	t_{ASC}	0	–	0	–	ns	
Column address hold time	t_{CAH}	10	–	15	–	ns	
$\overline{RAS}$ to $\overline{CAS}$ delay time	t_{RCD}	18	37	20	45		
$\overline{RAS}$ to column address delay time	t_{RAD}	13	25	15	30	ns	
$\overline{RAS}$ hold time	t_{RSH}	13		15	–	ns	
$\overline{CAS}$ hold time	t_{CSH}	50		60	–	ns	
$\overline{CAS}$ to $\overline{RAS}$ precharge time	t_{CRP}	5	–	5	–	ns	
Transition time (rise and fall)	t_T	3	50	3	50	ns	7
Refresh period	t_{REF}	–	16	–	16	ms	
Read Cycle							
Access time from $\overline{RAS}$	t_{RAC}	–	50	–	60	ns	8, 9
Access time from $\overline{CAS}$	t_{CAC}	–	13	–	15	ns	8, 9
Access time from column address	t_{AA}	–	25	–	30	ns	8,10
Column address to $\overline{RAS}$ lead time	t_{RAL}	25	–	30	–	ns	
Read command setup time	t_{RCS}	0	–	0	–	ns	
Read command hold time	t_{RCH}	0	–	0	–	ns	11
Read command hold time referenced to $\overline{RAS}$	t_{RRH}	0	–	0	–	ns	11
$\overline{CAS}$ to output in low-Z	t_{CLZ}	0	–	0	–	ns	8
Output buffer turn-off delay	t_{OFF}	0	13	0	15	ns	12

AC Characteristics (cont'd) [5)6)] M16F

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

Parameter	Symbol	Limit Values				Unit	Note
		-50		-60			
		min.	max.	min.	max.		
Early Write Cycle							
Write command hold time	t_{WCH}	8	–	10	–	ns	
Write command pulse width	t_{WP}	8	–	10	–	ns	
Write command setup time	t_{WCS}	0	–	0	–	ns	13
Write command to $\overline{RAS}$ lead time	t_{RWL}	13	–	15	–	ns	
Write command to $\overline{CAS}$ lead time	t_{CWL}	13	–	15	–	ns	
Data setup time	t_{DS}	0	–	0	–	ns	14
Data hold time	t_{DH}	10	–	10	–	ns	14
Fast Page Mode Cycle							
Fast page mode cycle time	t_{PC}	35	–	40	–	ns	
$\overline{CAS}$ precharge time	t_{CP}	10	–	10	–	ns	
Access time from $\overline{CAS}$ precharge	t_{CPA}	–	30	–	35	ns	7
$\overline{RAS}$ pulse width	t_{RAS}	50	200k	60	200k	ns	
$\overline{CAS}$ precharge to $\overline{RAS}$ Delay	t_{RHCP}	30	–	35	–	ns	
$\overline{CAS}$-before-$\overline{RAS}$ Refresh Cycle							
$\overline{CAS}$ setup time	t_{CSR}	10	–	10	–	ns	
$\overline{CAS}$ hold time	t_{CHR}	10	–	10	–	ns	
$\overline{RAS}$ to $\overline{CAS}$ precharge time	t_{RPC}	5	–	5	–	ns	
Write to $\overline{RAS}$ precharge time	t_{WRP}	10	–	10	–	ns	
Write hold time referenced to $\overline{RAS}$	t_{WRH}	10	–	10	–	ns	

Notes:

1) All voltages are referenced to V_{SS}.

2) I_{CC1}, I_{CC3}, I_{CC4} and I_{CC6} depend on cycle rate.

3) I_{CC1} and I_{CC4} depend on output loading. Specified values are measured with the output open.

4) An initial pause of 200 µs is required after power-up followed by 8 $\overline{\text{RAS}}$ cycles out 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.

5) 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}.

6) Measured with a load equivalant of 2 TTL loads and 100 pF.

7) t_{OFF} (max.) defines the time at which the output achieves the open-circuit condition and is not referenced to output voltage levels.

8) Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.

9) These parameters are referenced to the $\overline{\text{CAS}}$ leading edge.

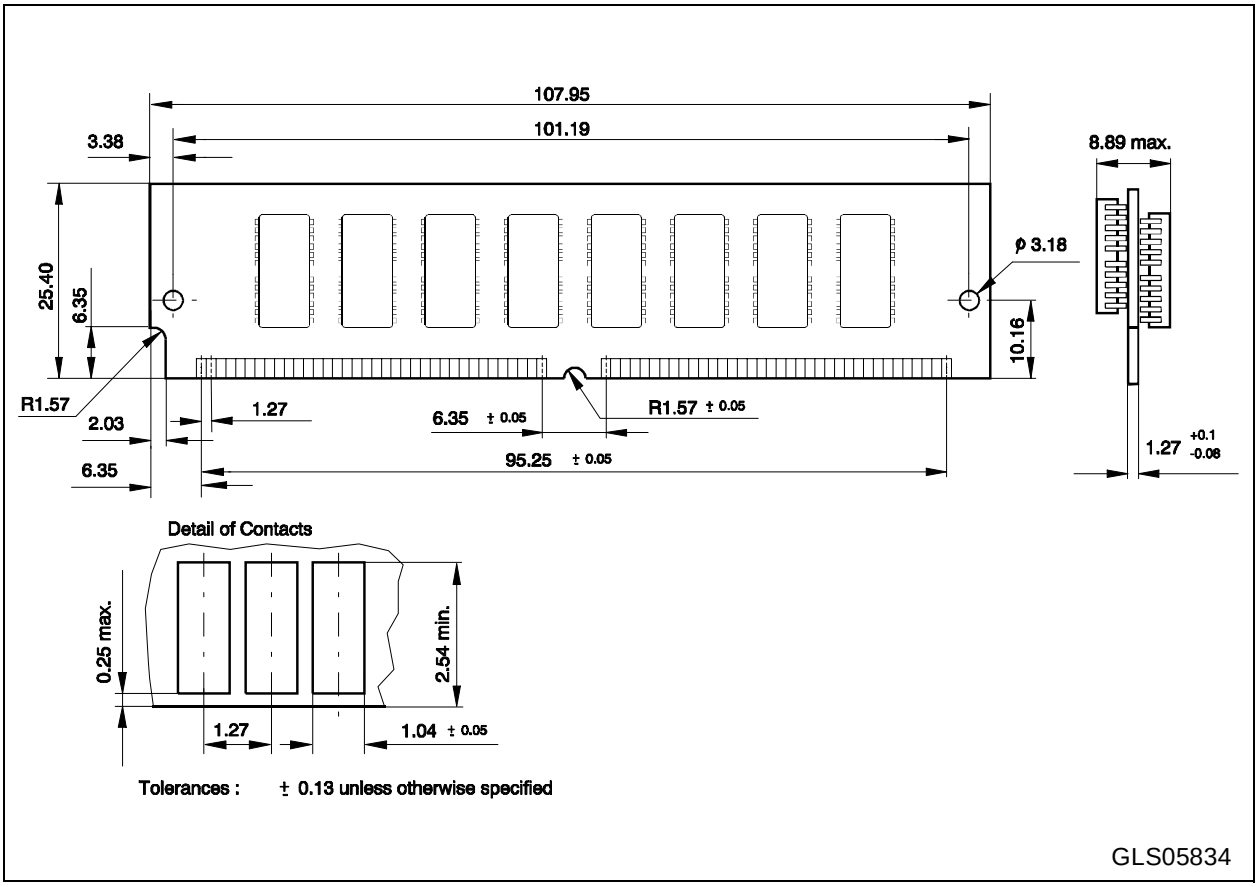
10) t_{WCS} is not a restrictive operating parameter. This is included in the data sheet as electrical characteristic only. If $t_{WCS} > t_{WCS}$ (min.), the cycle is an early write cycle and data out pin will remain open circuit (high impedance).

11) Operation within the t_{RCD} (max.) limit insures 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 access time is controlled by t_{CAC}.

12) Operation within the t_{RAD} (max.) limit insures 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 access time is controlled by t_{AA}.

13) For $\overline{\text{CAS}}$-before-$\overline{\text{RAS}}$ cycles only.

Package Outline



Module Package, L-SIM-72-11
(Single in-Line Memory Module)