

### DESCRIPTION

The HYM5328104B is a 8M x 32-bit EDO mode CMOS DRAM module consisting of sixteen HY5117404B in 24/26 pin SOJ or TSOPII on a 72 pin glass-epoxy printed circuit board. 0.1 $\mu$ F and 0.01 $\mu$ F decoupling capacitors are mounted for each DRAM.

The HYM532814BM/BSLM/BTM/BSLTM are Tin-Lead plated and HYM532814BMG/BSLMG/BTMG/BSLTMG are Gold plated socket type Single In-line Memory Modules suitable for easy interchange and addition of 32M byte memory.

### FEATURES

- Low power dissipation
  - Max. self-refresh 26.4mW (SL-part)
  - Max. battery back-up 44.0mW (SL-part)
  - Max. CMOS standby 35.2mW (SL-part)
    - 88.0mW
  - Max. TTL standby 176.0mW
  - Max. operating

Speed	Power
50	6.47W
60	5.37W
70	4.49W

- Single power supply of 5V $\pm$  10%
- TTL compatible inputs and outputs
- Fast access time

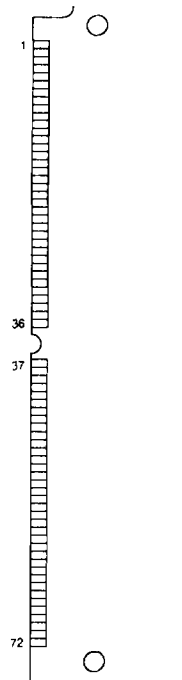
Speed	tRAC	tCAC	tHPC
50	50ns	13ns	20ns
60	60ns	15ns	25ns
70	70ns	18ns	30ns

- EDO mode operation
- CAS-before-RAS, RAS-only, Hidden refresh and Self-Refresh
- 2048 refresh cycles / 256ms (SL-part)
- 2048 refresh cycles / 32ms

### PIN DESCRIPTION

RAS0-RAS3	Row Address Strobe
CAS0-CAS3	Column Address Strobe
WE	Write Enable
A0-A10	Address Input
DQ0-DQ31	Data Input/Output
PD1-PD4	Presence Detect
Vcc	Power (+ 5V)
Vss	Ground

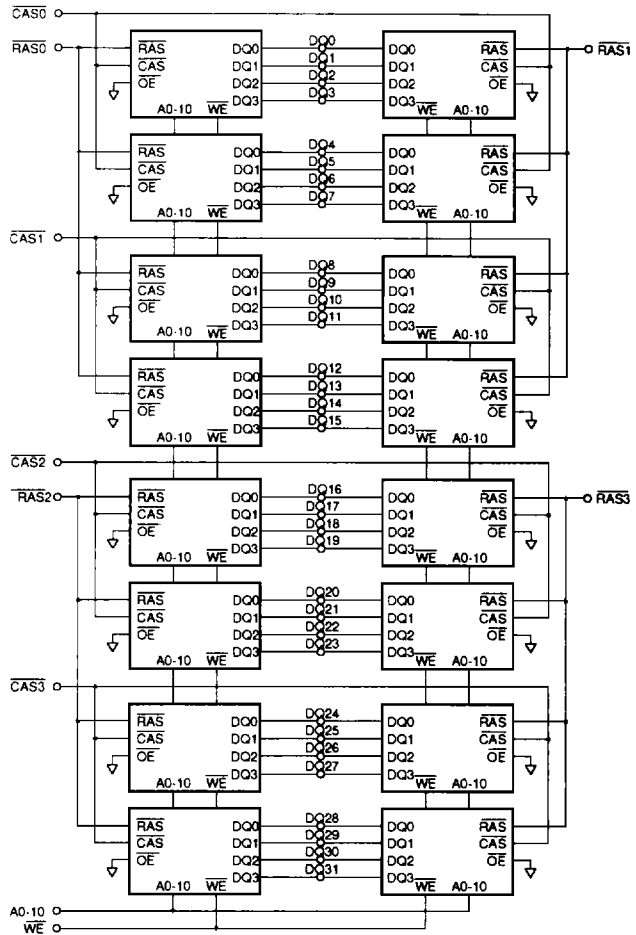
### PIN CONNECTION



PIN NAME

#	NAME	#	NAME
1	Vss	37	NC
2	DQ0	38	NC
3	DQ16	39	Vss
4	DQ1	40	CAS0
5	DQ17	41	CAS2
6	DQ2	42	CAS3
7	DQ18	43	CAS1
8	DQ3	44	RAS0
9	DQ19	45	RAS1
10	Vcc	46	NC
11	NC	47	WE
12	A0	48	NC
13	A1	49	DQ8
14	A2	50	DQ24
15	A3	51	DQ9
16	A4	52	DQ25
17	A5	53	DQ10
18	A6	54	DQ26
19	A10	55	DQ11
20	DQ4	56	DQ27
21	DQ20	57	DQ12
22	DQ5	58	DQ28
23	DQ21	59	Vcc
24	DQ6	60	DQ29
25	DQ22	61	DQ13
26	DQ7	62	DQ30
27	DQ23	63	DQ14
28	A7	64	DQ31
29	NC	65	DQ15
30	Vcc	66	NC
31	A8	67	PD1
32	A9	68	PD2
33	RAS3	69	PD3
34	RAS2	70	PD4
35	NC	71	NC
36	NC	72	Vss

BLOCK DIAGRAM



PRESENCE DETECT PIN

PIN	-50	-60	-70
PD1	NC	NC	NC
PD2	Vss	Vss	Vss
PD3	Vss	NC	Vss
PD4	Vss	NC	NC

**ABSOLUTE MAXIMUM RATINGS**

SYMBOL	PARAMETER	RATING	UNIT
TA	Ambient Temperature	0 to 70	°C
TSTG	Storage Temperature	-55 to 125	°C
VIN, VOUT	Voltage on Any Pin Relative to VSS	-1.0 to 7.0	V
VCC	Voltage on VCC Relative to VSS	-1.0 to 7.0	V
IOS	Short Circuit Output Current	50	mA
PD	Power Dissipation	8	W

NOTE : Operation at or above Absolute Maximum Ratings can adversely affect device reliability.

**RECOMMENDED DC OPERATING CONDITIONS**

(TA= 0°C to 70°C)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
VCC	Supply Voltage	4.5	5.0	5.5	V
VIH	Input High Voltage	2.4	-	VCC+ 1.0	V
VIL	Input Low Voltage	-1.0	-	0.8	V

NOTE : All voltages are referenced to Vss.

**DC CHARACTERISTICS**

(TA= 0°C to 70°C, VCC= 5V± 10%, VSS= 0V, unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS	SPEED/ POWER	MIN.	MAX.	UNIT	NOTE
ILI	Input Leakage Current (Any Input Pin)	VSS ≤ VIN ≤ VCC+ 1.0, All other pins not under test= VSS		-160	160	µA	
ILO	Output Leakage Current (High Impedance State)	VSS ≤ VOUT ≤ VCC, RAS & CAS at VIH		-20	20	µA	
ICC1	VCC Supply Current, Operating	tRC= tRC (min.)	50	-	1176	mA	1,2,3
			60	-	976		
			70	-	816		
ICC2	VCC Supply Current, TTL Standby	RAS & CAS at VIH, other inputs ≥ VSS		-	32	mA	
ICC3	VCC Supply Current, RAS-only refresh	tRC= tRC (min.)	50	-	1176	mA	1,3
			60	-	976		
			70	-	816		
ICC4	VCC Supply Current, EDO mode	tHPC= tHPC (min.)	50	-	1056	mA	1,2,3
			60	-	896		
			70	-	736		
ICC5	VCC Supply Current, CMOS Standby	RAS & CAS ≥ VCC-0.2V	SL-part	-	16 6.4	mA	5
ICC6	VCC Supply Current, CAS-before-RAS refresh	tRC= tRC (min.)	50	-	1176	mA	1,3
			60	-	976		
			70	-	816		
ICC7	VCC Supply Current, Battery Back Up (SL-part only)	tRC= 125µs, CAS= CBR cycling or 0.2V WE= VCC-0.2V A0-A10= VCC-0.2V or 0.2V DQ0-DQ31= VCC-0.2V, 0.2V, or open	tRAS ≤ 300ns	-	4.8	mA	1,4,5
			tRAS ≤ 1µs	-	8		
ICC8	VCC Supply Current Self Refresh (SL-part only)	RAS & CAS ≤ 0.2V OE & WE & A0-A10= VCC-0.2V or 0.2V DQ0-DQ31= VCC - 0.2V, 0.2V or open			4.8	mA	5
VOL	Output Low Voltage	IOL= 4.2mA		-	0.4	V	
VOH	Output High Voltage	IOH= -5mA		2.4	-	V	

**NOTE :**

1. ICC1, ICC3, ICC4, ICC6 and ICC7 depend on cycle rate.
2. ICC1, ICC3, ICC4 and ICC6 depend on output loading. Specified values are obtained with the output open.
3. ICC is specified as average current. For ICC1, ICC3 and ICC6 address can be changed maximum two times while RAS= VIL. For ICC4, address can be changed maximum once while CAS= VIH.
4. Only tRAS(max.)= 1µs is applied to refresh of battery backup but tRAS(max.)= 10µs is applied to normal functional operation.
5. ICC5(max.)= 6.4mA, ICC7 and ICC8 are applied to SL-part only (HYM532814BSLM/BSLTM/BSLMG/BSLTMG).

**AC CHARACTERISTICS**

(TA= 0°C to 70°C, VCC= 5V± 10%, VSS= 0V, unless otherwise noted.) NOTE : 1, 2, 3

#	SYMBOL	PARAMETER	HYM532814B M-series						UNIT	NOTE	
			-50		-60		-70				
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.			
1	tRC	Random Read or Write Cycle Time	84	-	104	-	124	-	ns		
2	tRPC	RAS to CAS Precharge Time	5	-	5	-	5	-	ns		
3	tHPC	EDO Mode Cycle Time	20	-	25	-	30	-	ns		
4	tRHCP	RAS Hold Time from CAS Precharge	-	30	-	35	-	40	-	ns	
5	tRAC	Access Time from RAS	-	50	-	60	-	70	-	ns	4,9,10
6	tCAC	Access Time from CAS	-	13	-	15	-	18	-	ns	4,9
7	tAA	Access Time from Column Address	-	25	-	30	-	35	-	ns	4,10
8	tCPA	Access Time from CAS Precharge	-	30	-	35	-	40	-	ns	4
9	tCLZ	CAS to Output Low Impedance	3	-	3	-	3	-	ns	4	
10	tCEZ	Output Buffer Turn-off Delay	3	13	3	15	3	18	ns	5	
11	tT	Transition Time (Rise and Fall)	2	50	2	50	2	50	ns	3	
12	tRP	RAS Precharge Time	30	-	40	-	50	-	ns		
13	tRAS	RAS Pulse Width	50	10K	60	10K	70	10K	ns		
14	tRASP	RAS Pulse Width (EDO Mode)	50	200K	60	200K	70	200K	ns		
15	tRSH	RAS Hold Time	13	-	15	-	18	-	ns		
16	tCSH	CAS Hold Time	40	-	45	-	50	-	ns		
17	tCAS	CAS Pulse Width	8	10K	11	10K	14	10K	ns		
18	tRCD	RAS to CAS Delay	18	37	20	45	20	52	ns	9	
19	tRAD	RAS to Column Address Delay Time	10	25	15	30	15	35	ns	10	
20	tCRP	CAS to RAS Precharge Time	5	-	5	-	5	-	ns		
21	tCP	CAS Precharge Time	8	-	10	-	12	-	ns		
22	tASR	Row Address Set-up Time	0	-	0	-	0	-	ns		
23	tRAH	Row Address Hold Time	8	-	10	-	10	-	ns		
24	tASC	Column Address Set-up Time	0	-	0	-	0	-	ns		
25	tCAH	Column Address Hold Time	10	-	10	-	15	-	ns		
26	tAR	Column Address Hold Time from RAS	50	-	50	-	50	-	ns		
27	tRAL	Column Address to RAS Lead Time	25	-	30	-	35	-	ns		
28	tRCS	Read Command Set-up Time	0	-	0	-	0	-	ns		
29	tRCH	Read Command Hold Time Referenced to CAS	0	-	0	-	0	-	ns	6	
30	tRRH	Read Command Hold Time Referenced to RAS	0	-	0	-	0	-	ns	6	
31	tWCH	Write Command Hold Time	8	-	10	-	10	-	ns		
32	tWCR	Write Command Hold Time from RAS	45	-	50	-	55	-	ns		
33	tWP	Write Command Pulse Width	8	-	10	-	10	-	ns		
34	tRWL	Write Command to RAS Lead Time	10	-	12	-	12	-	ns		
35	tCWL	Write Command to CAS Lead Time	10	-	12	-	12	-	ns		
36	tDS	Data-In Set-up Time	0	-	0	-	0	-	ns	7	
37	tDH	Data-In Hold Time	10	-	10	-	10	-	ns	7	
38	tDHR	Data-In Hold Time Referenced to RAS	50	-	50	-	50	-	ns		
39	tREF	Refresh Period (2048 cycles)	-	32	-	32	-	32	ms		
		SL-part	-	256	-	256	-	256	ms	12	
40	tWCS	Write Command Set-up Time	0	-	0	-	0	-	ns	8	

**AC CHARACTERISTICS**

(continued)

#	SYMBOL	PARAMETER	HYM532814B M-Series						UNIT	NOTE
			-50		-60		-70			
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
41	tCSR	CAS Set-up Time (CBR Cycle)	5	-	5	-	5	-	ns	
42	tCHR	CAS Hold Time (CBR Cycle)	10	-	10	-	10	-	ns	
43	tCPT	CAS Precharge Time (CBR Counter Test)	15	-	20	-	25	-	ns	
44	tWRP	WE to RAS Precharge Time (CBR Cycle)	10	-	10	-	10	-	ns	
45	tWRH	WE to RAS Hold Time (CBR Cycle)	10	-	10	-	10	-	ns	
46	tRASS	RAS Pulse (Self Refresh)	100	-	100	-	100	-	ns	
47	tRPS	RAS Precharge Time (Self Refresh)	90	-	110	-	130	-	ns	
48	tCHS	CAS Hold Time from RAS (Self Refresh)	-50	-	-50	-	-50	-	ns	
49	tDOH	Output Data Hold Time	5	-	5	-	5	-	ns	
50	tREZ	Output Buffer Turn-off Delay (RAS)	3	13	3	15	3	18	ns	5,15
51	tWEZ	Output Buffer Turn-off Delay (WE)	3	13	3	15	3	18	ns	5
52	tWPE	WE Pulse Width for Output Disable	5	-	5	-	8	-	ns	
53	tWED	WE to Data Delay Time	13	-	15	-	18	-	ns	

**NOTE :**

1. An initial pause of 200µs is required after power-up followed by 8  $\overline{\text{RAS}}$  cycles 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  $\overline{\text{RAS}}$ -only refresh cycles are required. The device should be carefully initialized to be prevented from being entered into multi bit test mode.
2. If  $\overline{\text{RAS}} = \text{Vss}$  during power-up, the HYM532814B could begin an active cycle. This condition results in higher power-up current than necessary demands from the power-up. It is recommended that  $\overline{\text{RAS}}$  and  $\overline{\text{CAS}}$  track with  $\text{VCC}$  during power-up or be held at a valid  $\text{VIH}$  in order to minimize the power-up current.
3. Refer to the HY5117404B data sheet for detailed information.
4. Measured with a load equivalent to 2 TTL loads and 100pF. ( $\text{VOH} = 2.0\text{v}$ ,  $\text{VOL} = 0.8\text{V}$ )
5.  $\text{tCEZ}(\text{max.})$ ,  $\text{tOEZ}(\text{MAX.})$ ,  $\text{tREZ}(\text{MAX.})$  and  $\text{tWEZ}(\text{MAX.})$  define the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
6. Either  $\text{tRCH}$  or  $\text{tRRH}$  must be satisfied for a read cycle.
7. These parameters are referenced to  $\overline{\text{CAS}}$  leading edge in early write cycles and to  $\overline{\text{WE}}$  leading edge in late write or read-modify-write cycles.
8.  $\text{twCS}$  is not a restrictive operating parameter. It is included in the data sheet as electrical characteristics only. If  $\text{twCS} \geq \text{twCS}(\text{min.})$ , the cycle is an early write cycle and data out pin will remain open circuit (high impedance) through the entire cycle.
9. Operation within the  $\text{tRCD}(\text{max.})$  limit insures that  $\text{tRAC}(\text{max.})$  can be met.  $\text{tRCD}(\text{max.})$  is specified as a reference point only. If  $\text{tRCD}$  is greater than the specified  $\text{tRCD}(\text{max.})$  limit, then access time is controlled by  $\text{tCAC}$ .
10. Operation within the  $\text{tRAD}(\text{max.})$  limit insures that  $\text{tRAC}(\text{max.})$  can be met.  $\text{tRAD}(\text{max.})$  is specified as a reference point only. If  $\text{tRAD}$  is greater than the specified  $\text{tRAD}(\text{max.})$  limit, then access time is controlled by  $\text{tAA}$ .
11. Measured with the specified current load and 100pF.
12. A burst of 2048  $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$  refresh cycles must be executed within 32ms after exiting self refresh (for SL-part).
13. If  $\text{tCWD} \geq \text{twCS}(\text{MIN.})$ ,  $\text{tRWD} \geq \text{tRWD}(\text{MIN.})$ ,  $\text{tAWD} \geq \text{tAWD}(\text{MIN.})$  and  $\text{tCPWD} \geq \text{tCPWD}(\text{MIN.})$ , the cycle is a read modify write cycle and the data output will contain data read from the selected cell. If neither of the above conditions are met, the condition of the data out (at access time and until  $\overline{\text{CAS}}$  goes back to  $\text{VIH}$ ) is indeterminated.
14. In  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  self refresh mode.  
 In case of using distributed  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  refresh, refresh 2048 times during a 256ms after reset  
 In case of using burst  $\overline{\text{CAS}}$  before  $\overline{\text{RAS}}$  refresh, refresh 2048 times during a 32ms after reset  
 In case of using  $\overline{\text{RAS}}$  only refresh, refresh against all refresh address during a 32ms after reset
15. If  $\overline{\text{RAS}}$  goes to high before  $\overline{\text{CAS}}$  high going, the open circuit condition of the output is achieved by  $\overline{\text{CAS}}$  high going. If  $\overline{\text{CAS}}$  goes to high before  $\overline{\text{RAS}}$  high going, the open circuit condition of the output is achieved by  $\overline{\text{RAS}}$  high going.

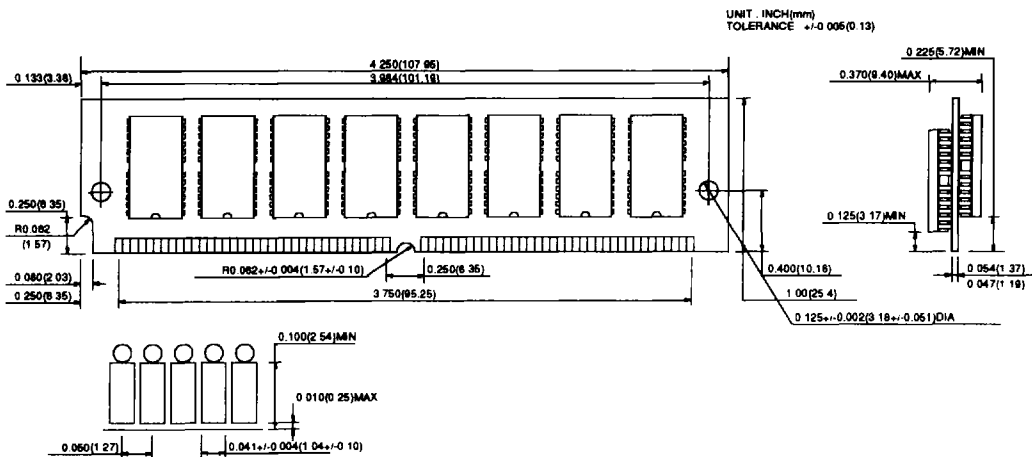
**CAPACITANCE**

( $\text{TA} = 25^\circ\text{C}$ ,  $\text{VCC} = 5\text{V} \pm 10\%$ ,  $\text{VSS} = 0\text{V}$ ,  $f = 1\text{MHz}$ , unless otherwise noted.)

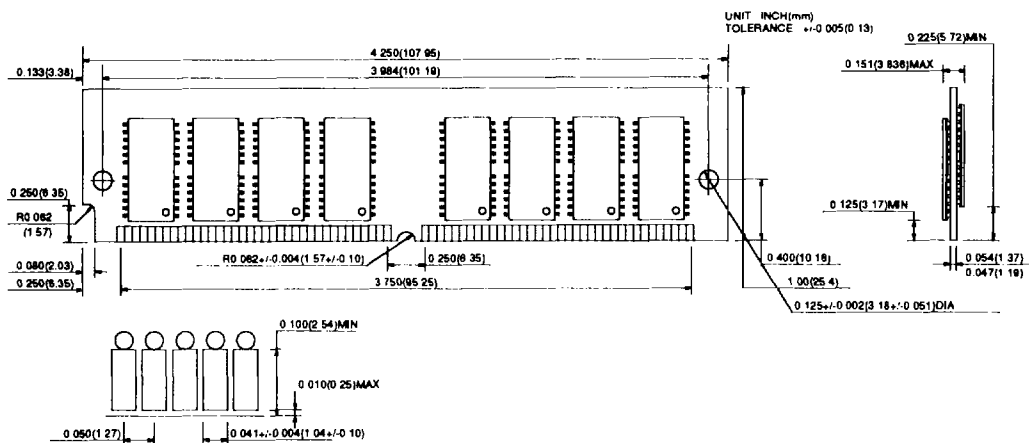
SYMBOL	PARAMETER	TYP.	MAX.	UNIT
CIN1	Input Capacitance (A0-A10)	-	110	pF
CIN2	Input Capacitance ( $\overline{\text{WE}}$ )	-	120	pF
CIN3	Input Capacitance ( $\overline{\text{RAS0-RAS3}}$ )	-	35	pF
CIN4	Input Capacitance ( $\overline{\text{CAS0-CAS3}}$ )	-	35	pF
CDQ	Data Input/output Capacitance (DQ0-DQ31)	-	25	pF

**PACKAGE INFORMATION**

**72 pin Single In-line Memory (M ; Tin-Lead plated, MG ; Gold plated)  
HYM532814B (SOJ Mounted)**



**HYM532814B (TSOPII Mounted)**



**ORDERING INFORMATION**

<b>PART NUMBER</b>	<b>SPEED</b>	<b>POWER</b>	<b>PACKAGE</b>	<b>PLATING</b>
HYM532814BM	50/60/70		SIMM	Tin-Lead
HYM532814BSLM	50/60/70	SL-part	SIMM	Tin-Lead
HYM532814BTM	50/60/70		SIMM	Tin-Lead
HYM532814BSLTM	50/60/70	SL-part	SIMM	Tin-Lead
HYM532814BMG	50/60/70		SIMM	Gold
HYM532814BSLMG	50/60/70	SL-part	SIMM	Gold
HYM532814BTMG	50/60/70		SIMM	Gold
HYM532814BSLTMG	50/60/70	SL-part	SIMM	Gold