GoldStar
GOLDSTAR ELECTRON CO., LTD.

GMM7361000BS/BSG-60/70/80
GMM7361000BSS/BSGS-60/70/80
1,048,576 WORDS x 36 BIT
GMM7362000BS/BSG-60/70/80
2,097,152 WORDS x 36 BIT/CMOS DYNAMIC RAM MODULE

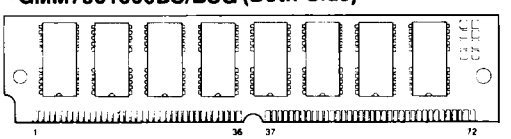
Description

The GMM7361000BSG/BSGS is a 1M x 36 bits dynamic RAM MODULE which is assembled 8 pieces of 1M x 4 bit DRAMs and 4 pieces of 1M x 1 bit DRAMs in 20/26 pin SOJ package on both/single side the printed circuit board with decoupling capacitors.

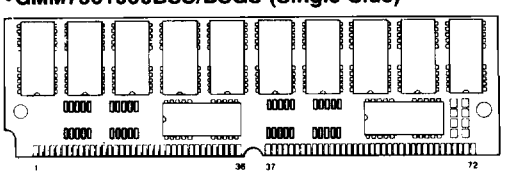
The GMM7362000BS/BSG is a 2M x 36 bits dynamic RAM MODULE which is assembled 16 pieces of 1M x 4 bit DRAMs and 8 pieces of 1M x 1 bit DRAMs in 20/26 pin SOJ package on both sides the printed circuit board with decoupling capacitors.

These are optimized for application to the systems which are required high density and large capacity such as main memory of the computers and an image memory systems, and to the others which are requested compact size. These provide common data inputs and outputs.

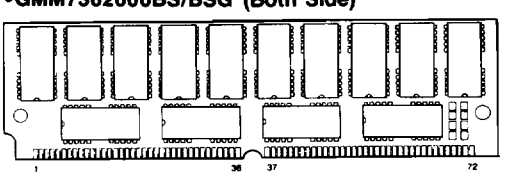
•GMM7361000BS/BSG (Both Side)*1



•GMM7361000BSS/BSGS (Single Side)



•GMM7362000BS/BSG (Both Side)*2



Features

- 72 pins Single In-Line Package
  - GMM736XXXXBS: Tin-Lead Plate
  - GMM736XXXXBSG: Gold Plate
- Fast Page Mode Capability
- Single Power Supply
- Fast Access Time & Cycle Time (Unit: ns)

	t_{RAC}	t_{CAC}	t_{RC}	t_{PC}
GMM7361(2)000XXX-60	60	20	120	45
GMM7361(2)000XXX-70	70	20	130	50
GMM7361(2)000XXX-80	80	25	160	55

- Low Power
  Active
  - 1M x 36: 6,820/6,160/5,500 mW(MAX)
  - 2M x 36: 6,952/6,292/6,632 mW(MAX)
  Standby
  - 1M x 36: 66 mW(CMOS level; MAX)
  - 2M x 36: 138 mW(CMOS level; MAX)
- $\overline{RAS}$ Only Refresh, $\overline{CAS}$ before $\overline{RAS}$ Refresh Hidden Refresh
- All inputs and outputs TTL Compatible
- 1024 Refresh Cycles/16ms

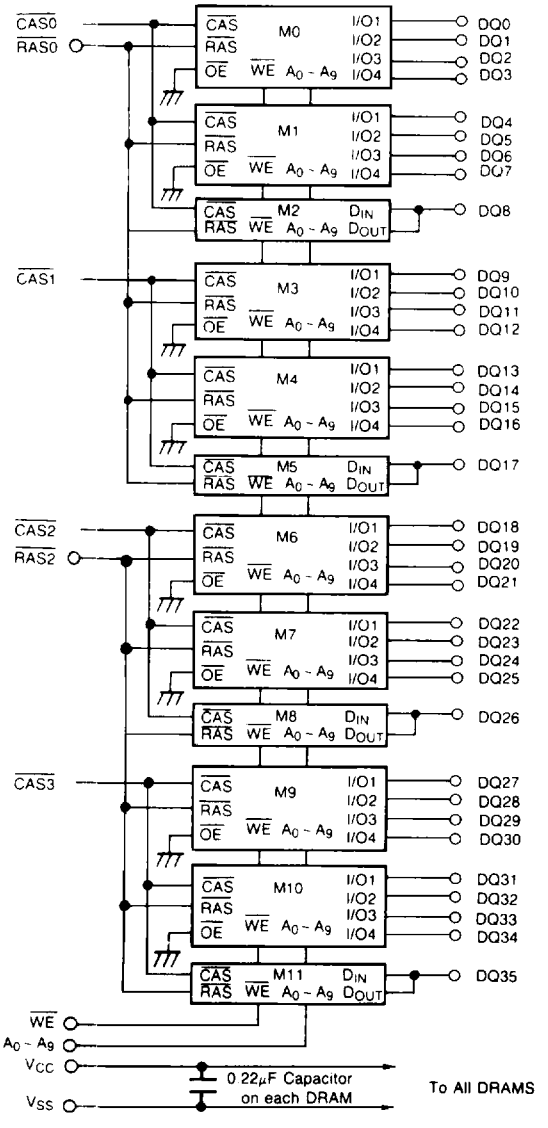
Pin Configuration (Top View)

Pin	Symbol	Pin	Symbol	Pin	Symbol	Pin	Symbol
1	V_{SS}	19	NC	37	DQ_{17}	55	DQ_{12}
2	DQ_0	20	DQ_4	38	DQ_{35}	56	DQ_{30}
3	DQ_{18}	21	DQ_{22}	39	V_{SS}	57	DQ_{13}
4	DQ_1	22	DQ_5	40	$\overline{CAS_0}$	58	DQ_{31}
5	DQ_{19}	23	DQ_{23}	41	$\overline{CAS_2}$	59	V_{CC}
6	DQ_2	24	DQ_6	42	$\overline{CAS_3}$	60	DQ_{32}
7	DQ_{20}	25	DQ_{24}	43	$\overline{CAS_1}$	61	DQ_{14}
8	DQ_3	26	DQ_7	44	$\overline{RAS_0}$	62	DQ_3
9	DQ_{21}	27	DQ_{25}	45	$\overline{RAS_1}$*3	63	DQ_{15}
10	V_{CC}	28	A_7	46	NC	64	DQ_{34}
11	NC	29	NC	47	$\overline{WE}$	65	DQ_{16}
12	A_0	30	V_{CC}	48	NC	66	NC
13	A_1	31	A_8	49	DQ_9	67	PD_1
14	A_2	32	A_9	50	DQ_{27}	68	PD_2
15	A_3	33	$\overline{RAS_3}$*3	51	DQ_{10}	69	PD_3
16	A_4	34	$\overline{RAS_2}$	52	DQ_{28}	70	PD_4
17	A_5	35	DQ_{26}	53	DQ_{11}	71	NC
18	A_6	36	DQ_8	54	DQ_{29}	72	V_{SS}

Note: 1. There are 4 pieces of 1M x 1 bit DRAM on the rear side.
2. There are 8 pieces of 1M x 4 bit DRAM and 2 pieces of 1M x 1 bit DRAM on the rear side.
3. In case of GMM7361000BSG/BSGS, Pin 33 and Pin 45 are no connection.

Block Diagram

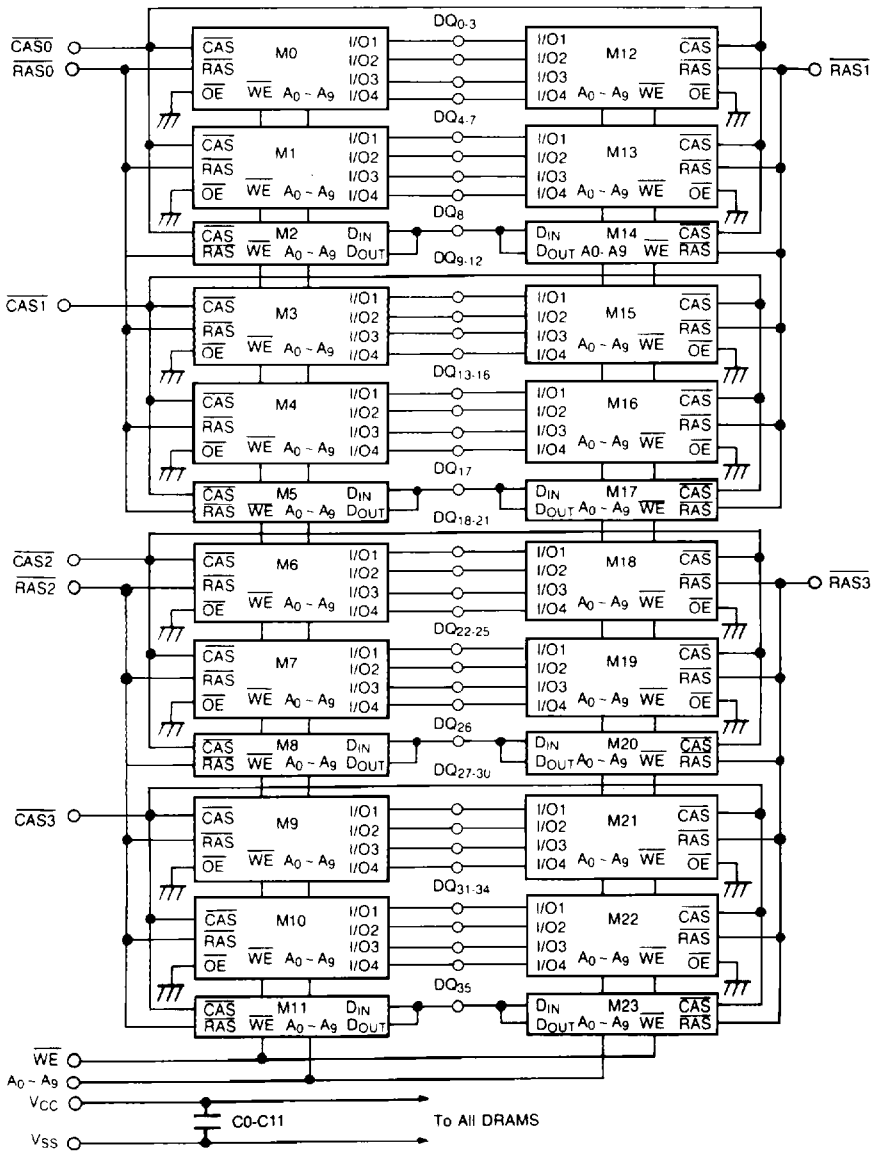
- **GMM7361000BS/BSG**
- **GMM7361000BSS/BSGS**



*Note: M2, M5, M8, M11 are GM71C1000BJ & others are GM71C4400BJ.

Block Diagram

- **GMM7362000BS/BSG**



*Note 1. M2, M5, M8, M11, M14, M17, M20, M23 are GM71C1000BJ & others are GM71C4400BJ.
2. C0-C11: 0.22μF Capacitor.

Pin Description

Pin	Function	Pin	Function
A_0 ~ A_9	Address Inputs	PD1 ~ PD4	Presence Detect
DQ_0 ~ DQ_{35}	Data Input/Output	V_{CC}	Power (+5V)
$\overline{RAS0}$ ~ $\overline{RAS3}$	Row Address Strobe	V_{SS}	Ground
$\overline{CAS0}$ ~ $\overline{CAS3}$	Column Address Strobe	NC	No Connection
$\overline{WE}$	Read/Write Enable		

Presence Detect Pins

•GMM7361000BS/BSG, GMM7361000BSS/BSGS

Pin	60ns	70ns	80ns
PD1	V_{SS}	V_{SS}	V_{SS}
PD2	V_{SS}	V_{SS}	V_{SS}
PD3	NC	V_{SS}	NC
PD4	NC	NC	V_{SS}

•GMM7362000BS/BSG

Pin	60ns	70ns	80ns
PD1	NC	NC	NC
PD2	NC	NC	NC
PD3	NC	V_{SS}	NC
PD4	NC	NC	V_{SS}

Absolute Maximum Ratings*[1]

Symbol	Parameter	Rating	Unit
T_A	Ambient Temperature under Bias	0 ~ 70	°C
T_{STG}	Storage Temperature	-55 ~ 125	°C
V_{IN}/V_{OUT}	Voltage on any Pin Relative to V_{SS}	-1.0 ~ 7.0	V
V_{CC}	Power Supply Voltage	-1.0 ~ 7.0	V
I_{OUT}	Short Circuit Output Current	50	mA
P_D	Power Dissipation	12/24*[2]	W

*Note 1. Stress greater than above under "Absolute Maximum Ratings" may cause permanent damage to the device.
2. GMM7362000BS/BSG.

Recommended DC Operating Conditions (T_A = 0 ~ 70°C)

Symbol	Parameter	Min	Typ	Max	Unit	Note
V_{CC}	Supply Voltage	4.5	5.0	5.5	V	1
V_{IH}	Input High Voltage	2.4	–	6.5	V	1
V_{IL}	Input Low Voltage	-1.0	–	0.8	V	1

Note: 1. All Voltages referenced to V_{SS}

DC Electrical Characteristics: (V_{CC} = 5V ± 10%, T_A = 0 ~ 70°C)

Symbol	Parameter		GMM7361000XXX		GMM7362000XXX		Unit	Notes
			Min	Max	Min	Max		
V_{OH}	Output Level Output "H" Level Voltage (I_{OUT} = -5mA)		2.4	V_{CC}	2.4	V_{CC}	V	
V_{OL}	Output Level Output "L" Level Voltage (I_{OUT} = 4.2mA)		0	0.4	0	0.4	V	
I_{CC1}	Operating Current Average Power Supply Operating Current ($\overline{RAS}$, $\overline{CAS}$, Address Cycling: t_{RC} = t_{RC} min)	60ns	—	1240	—	1264	mA	1,2
		70ns	—	1120	—	1144		
		80ns	—	1000	—	1024		
I_{CC2}	Standby Current (TTL) Power Supply Standby Current ($\overline{RAS}$, $\overline{CAS}$ = V_{IH})		—	24	—	48	mA	
I_{CC3}	$\overline{RAS}$ Only Refresh Current Average Power Supply Current $\overline{RAS}$ Only Mode ($\overline{RAS}$ Cycling, $\overline{CAS}$ = V_{IH}, t_{RC} = min)	60ns	—	1240	—	1264	mA	2
		70ns	—	1120	—	1144		
		80ns	—	960	—	984		
I_{CC4}	Fast Page Mode Current Average Power Supply Current Fast Page Mode ($\overline{RAS}$ = V_{IL}, $\overline{CAS}$ Address Cycling: t_{PC} = t_{PC} min)	60ns	—	1200	—	1124	mA	1,3
		70ns	—	1080	—	1104		
		80ns	—	920	—	944		
I_{CC5}	Standby Current (CMOS) Power Supply Standby Current ($\overline{RAS}$, $\overline{CAS}$ = V_{CC} - 0.2V)		—	12	—	24	mA	
I_{CC6}	$\overline{CAS}$ before $\overline{RAS}$ Refresh Current (t_{RC} = t_{RC} min)	60ns	—	1200	—	1224	mA	
		70ns	—	1080	—	1104		
		80ns	—	960	—	984		
I_{CC7}	Standby Current $\overline{RAS}$ = V_{IH} $\overline{CAS}$ = V_{IL} D_{OUT} = Enable		—	60	—	120	mA	1
$I_{I(L)}$	Input Leakage Current Any Input ($0V \leq V_{IN} \leq 7V$) All Other Pins Not Under Test = 0V		-120	120	-240	240	μA	
$I_{O(L)}$	Output Leakage Current (D_{OUT} is Disabled, $0V \leq V_{OUT} \leq 7V$)		-20	20	-20	20	μA	

Note) 1. I_{CC} depends on output loading condition when the device is selected, I_{CC} (max) is specified at the output open condition.
2. Address can be changed less than three times while $\overline{RAS}$ = V_{IL}
3. Address can be changed once or less while $\overline{CAS}$ = V_{IH}

Capacitance (V_{CC} = 5V ± 10%, T_A = 25°C, f = 1MHz)

Symbol	Parameter	GMM7361000XXX		GMM7362000XXX		Unit	Notes
		Min	Max	Min	Max		
C_{I1}	Input Capacitance (A0 ~ A9)	–	88	–	140	pF	1
C_{I2}	Input Capacitance ($\overline{WE}$)	–	104	–	188	pF	1,2
C_{I3}	Input Capacitance ($\overline{RAS0}$ ~ $\overline{RAS3}$)	–	42	–	42	pF	1,2
C_{I4}	Input Capacitance ($\overline{CAS0}$ ~ $\overline{CAS3}$)	–	36	–	42	pF	1,2
CDQ_1	I/O Capacitance (DQ0 ~ 7, 9 ~ 16, 18 ~ 25, 27 ~ 34)	–	17	–	30	pF	1,2
CDQ_2	I/O Capacitance (DQ8, 17, 26, 35)	–	22	–	24	pF	1,2

Note 1. Capacitance shall be measured with Boonton Meter or effective capacitance measuring method.
2. $\overline{CAS}$ = V_{IH} to disable D_{OUT}.

AC Electrical Characteristics (V_{CC} = 5V ± 10%, T_A = 0 ~ 70°C, Notes 1,14)

The GMM736XXXX writes data only in early write cycle($t_{WCS} \geq t_{WCS(min)}$).
Delayed write cycle is not available because of I/O common.

Read, Write and Refresh Cycles (Common Parameters)

Symbol	Parameter	GMM736XXXX-60		GMM736XXXX-70		GMM736XXXX-80		Unit	Notes
		Min	Max	Min	Max	Min	Max		
t_{RC}	Random Read or Write Cycle Time	120	–	130	–	160	–	ns	
t_{RP}	$\overline{RAS}$ Precharge Time	50	–	50	–	70	–	ns	
t_{RAS}	$\overline{RAS}$ Pulse Width	60	10,000	70	10,000	80	10,000	ns	
t_{CAS}	$\overline{CAS}$ Pulse Width	20	10,000	20	10,000	25	10,000	ns	
t_{ASR}	Row Address Set-up Time	0	–	0	–	0	–	ns	
t_{RAH}	Row Address Hold Time	10	–	10	–	12	–	ns	
t_{ASC}	Column Address Set-up Time	0	–	0	–	0	–	ns	
t_{CAH}	Column Address Hold Time	15	–	15	–	20	–	ns	
t_{RCD}	$\overline{RAS}$ to $\overline{CAS}$ Delay Time	20	40	20	50	22	55	ns	8
t_{RAD}	$\overline{RAS}$ to Column Address Delay Time	15	30	15	35	17	40	ns	9
t_{RSH}	$\overline{RAS}$ Hold Time	20	–	20	–	25	–	ns	
t_{CSH}	$\overline{CAS}$ Hold Time	60	–	70	–	80	–	ns	
t_{CRP}	$\overline{CAS}$ to $\overline{RAS}$ Precharge Time	10	–	10	–	10	–	ns	
t_T	Transition Time (Rise and Fall)	3	50	3	50	3	50	ns	7
t_{REF}	Refresh Period	–	16	–	16	–	16	ms	

Read Cycle

Symbol	Parameter	GMM736XXXX-60		GMM736XXXX-70		GMM736XXXX-80		Unit	Notes
		Min	Max	Min	Max	Min	Max		
t_{RAC}	Access Time from $\overline{RAS}$	–	60	–	70	–	80	ns	2,3
t_{CAC}	Access Time from $\overline{CAS}$	–	20	–	20	–	25	ns	3,4
t_{AA}	Access Time from Column Address	–	30	–	35	–	40	ns	3,5
t_{RCS}	Read Command Set-up Time	0	–	0	–	0	–	ns	
t_{RCH}	Read Command Hold Time to $\overline{CAS}$	0	–	0	–	0	–	ns	
t_{RRH}	Read Command Hold Time to $\overline{RAS}$	10	–	10	–	10	–	ns	
t_{RAL}	Column Address to $\overline{RAS}$ Lead Time	30	–	35	–	40	–	ns	
t_{OFF}	Output Buffer Turn-off Time	–	20	–	20	–	20	ns	6

Write Cycle

Symbol	Parameter	GMM736XXXX-60		GMM736XXXX-70		GMM736XXXX-80		Unit	Notes
		Min	Max	Min	Max	Min	Max		
t_{WCS}	Write Command Set-up Time	0	–	0	–	0	–	ns	10
t_{WCH}	Write Command Hold Time	15	–	15	–	20	–	ns	
t_{WP}	Write Command Pulse Width	10	–	10	–	15	–	ns	
t_{RWL}	Write Command to $\overline{RAS}$ Lead Time	20	–	20	–	25	–	ns	
t_{CWL}	Write Command to $\overline{CAS}$ Lead Time	20	–	20	–	25	–	ns	
t_{DS}	Data-in Set-up Time	0	–	0	–	0	–	ns	11
t_{DH}	Data-in Hold Time	15	–	15	–	20	–	ns	11

Refresh Cycle

Symbol	Parameter	GMM736XXXX-60		GMM736XXXX-70		GMM736XXXX-80		Unit	Notes
		Min	Max	Min	Max	Min	Max		
t_{CSR}	$\overline{CAS}$ Set-up Time ($\overline{CAS}$-before-$\overline{RAS}$ Refresh Cycle)	10	–	10	–	10	–	ns	
t_{CHR}	$\overline{CAS}$ Hold Time ($\overline{CAS}$-before-$\overline{RAS}$ Refresh Cycle)	15	–	15	–	20	–	ns	
t_{RPC}	$\overline{RAS}$ Precharge to $\overline{CAS}$ Hold Time	10	–	10	–	10	–	ns	
t_{CPN}	$\overline{CAS}$ Precharge Time in Normal Mode	10	–	10	–	10	–	ns	

Fast Page Mode Cycle

Symbol	Parameter	GMM736XXXX-60		GMM736XXXX-70		GMM736XXXX-80		Unit	Notes
		Min	Max	Min	Max	Min	Max		
t_{PC}	Fast-Page Mode Cycle Time	45	–	50	–	55	–	ns	
t_{CP}	Fast Page Mode $\overline{CAS}$ Precharge Time	10	–	10	–	10	–	ns	
t_{RASC}	Fast Page Mode $\overline{RAS}$ Pulse Width	–	100,000	–	100,000	–	100,000	ns	12
t_{ACP}	Access Time from $\overline{CAS}$ Precharge	–	40	–	45	–	50	ns	13
t_{RHCP}	$\overline{RAS}$ Hold Time from $\overline{CAS}$ Precharge	40	–	45	–	50	–	ns	

Notes :

1. AC measurements assume t_T = 5ns.
2. Assumes that $t_{RCD} \leq t_{RCD}(max)$ and $t_{RAD} \leq t_{RAD}(max)$. If t_{RCD} or t_{RAD} is greater than the maximum recommended value shown in this table, t_{RAC} exceeds the value shown.
3. Measured with a load circuit equivalent to 2TTL loads and 100pF.
4. Assumes that $t_{RCD} \geq t_{RCD}(max)$ and $t_{RAD} \leq t_{RAD}(max)$.
5. Assumes that $t_{RCD} \leq t_{RCD}(max)$ and $t_{RAD} \geq t_{RAD}(max)$.
6. t_{OFF} (max) defines the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
7. V_{IH}(min) and V_{IL}(max) are reference levels for measuring timing of input signals. Also, transition times are measured between V_{IH} and V_{IL}.
8. Operation with 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 exclusively by t_{CAC}.
9. Operation with 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 exclusively by t_{AA}.
10. t_{WCS} is not restrictive operating parameters. It is included in the data sheet as electrical characteristics only. If $t_{WCS} \geq t_{WCS}$(min), the cycle is an early write cycle and the data out pin will remain open circuit (high impedance) throughout the entire cycle.
11. These parameters are referenced to $\overline{CAS}$ leading edge in early write cycles.
12. t_{RASC} is defines $\overline{RAS}$ pulse width in Fast Page Mode cycles.
13. Access time is determined by the longer of t_{AA} or t_{CAC} or t_{ACP}.
14. An initial pause of 100 μs is required after power up followed by a minimum of eight initialization cycels (any combination of cycles containing $\overline{RAS}$ clock such as $\overline{RAS}$ only refresh). If the internal refresh counter is used, a minimum of eight $\overline{CAS}$-before-$\overline{RAS}$ refresh cycles are required.

TIMING WAVEFORMS

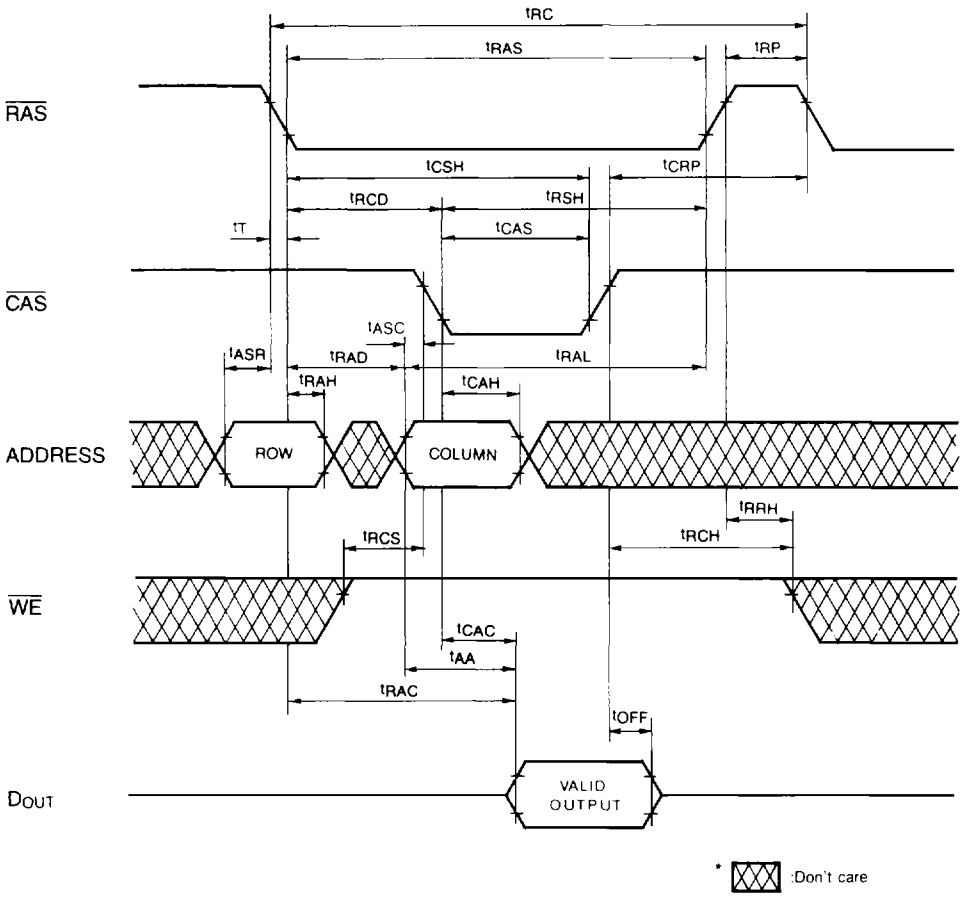


FIGURE 1. READ CYCLE

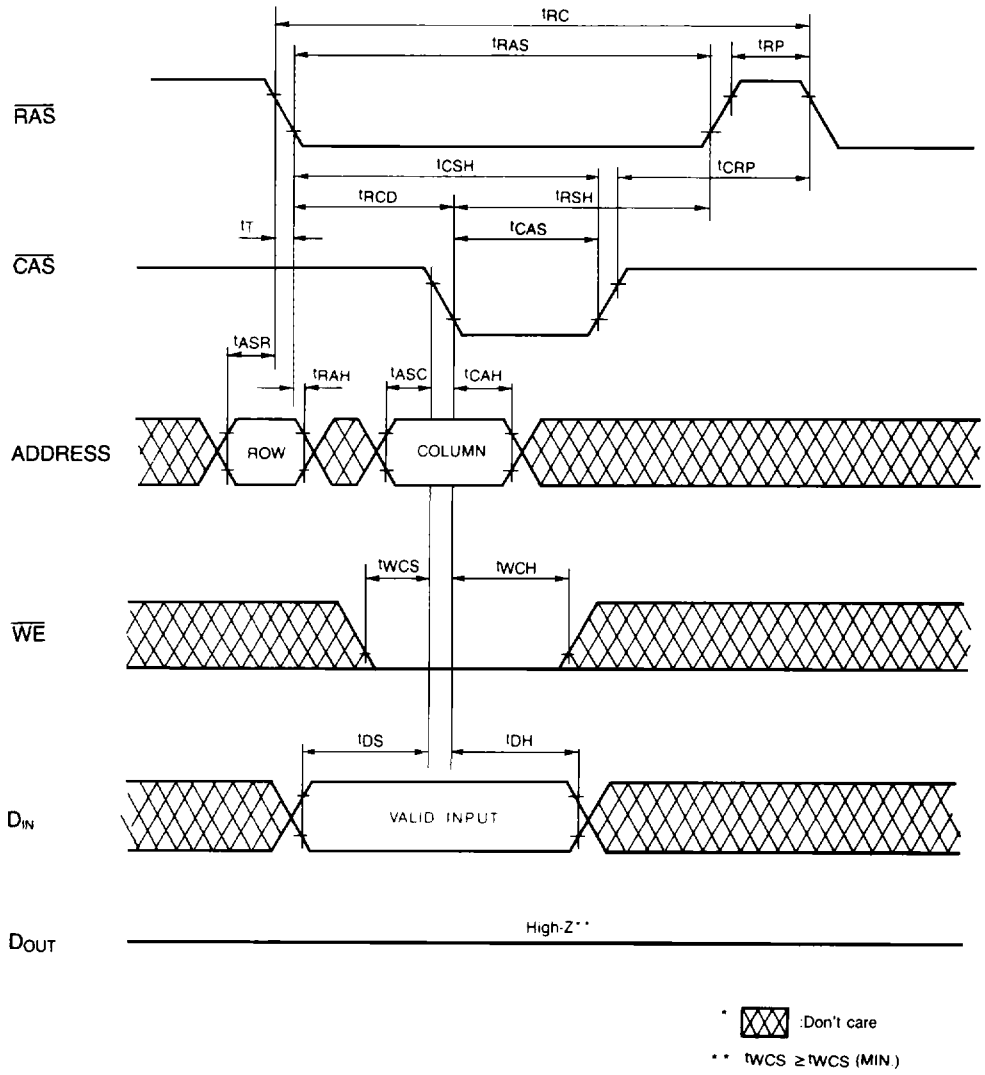


FIGURE 2. EARLY WRITE CYCLE

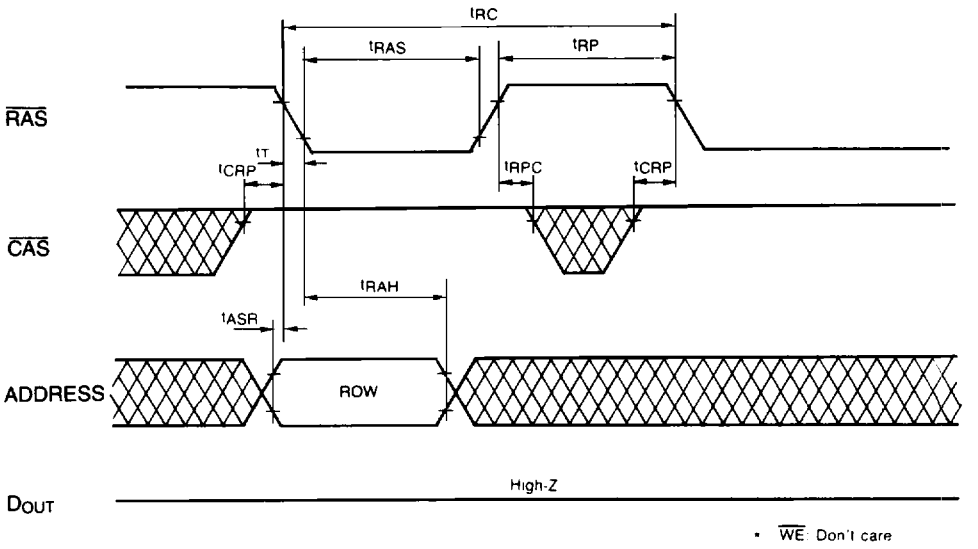


FIGURE 3. RAS-ONLY-REFRESH CYCLE

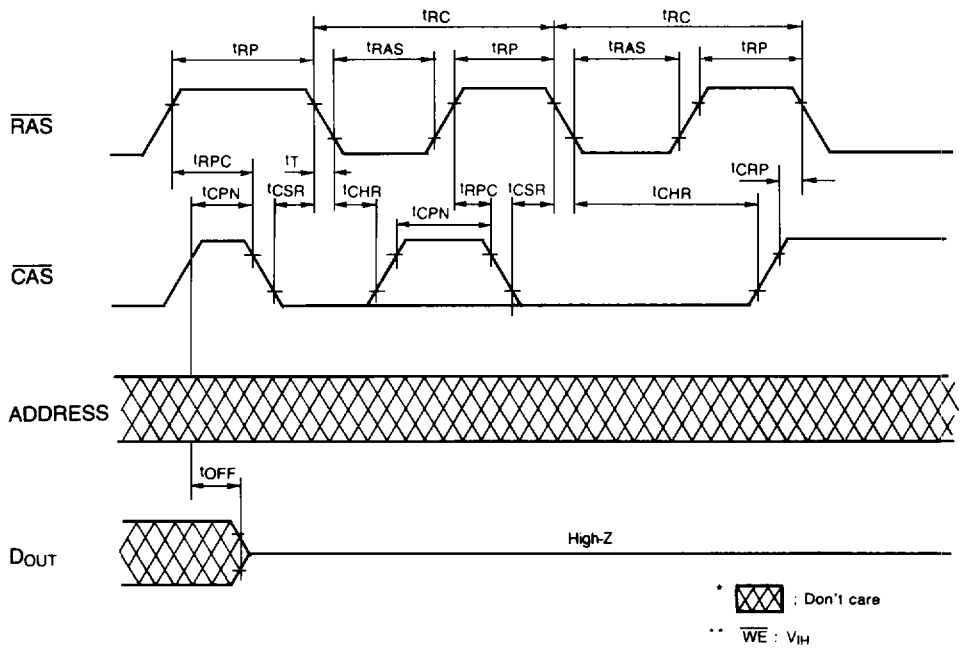


FIGURE 4. CAS-BEFORE-RAS REFRESH CYCLE

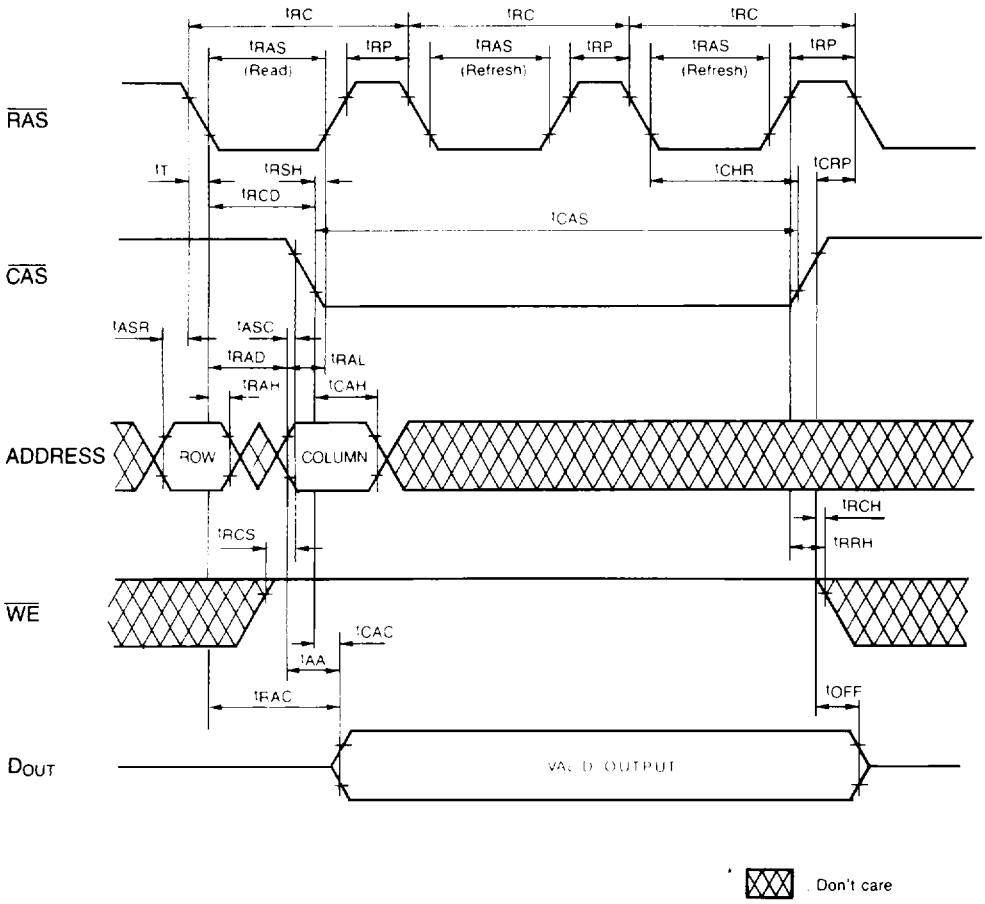


FIGURE 5. HIDDEN REFRESH CYCLE

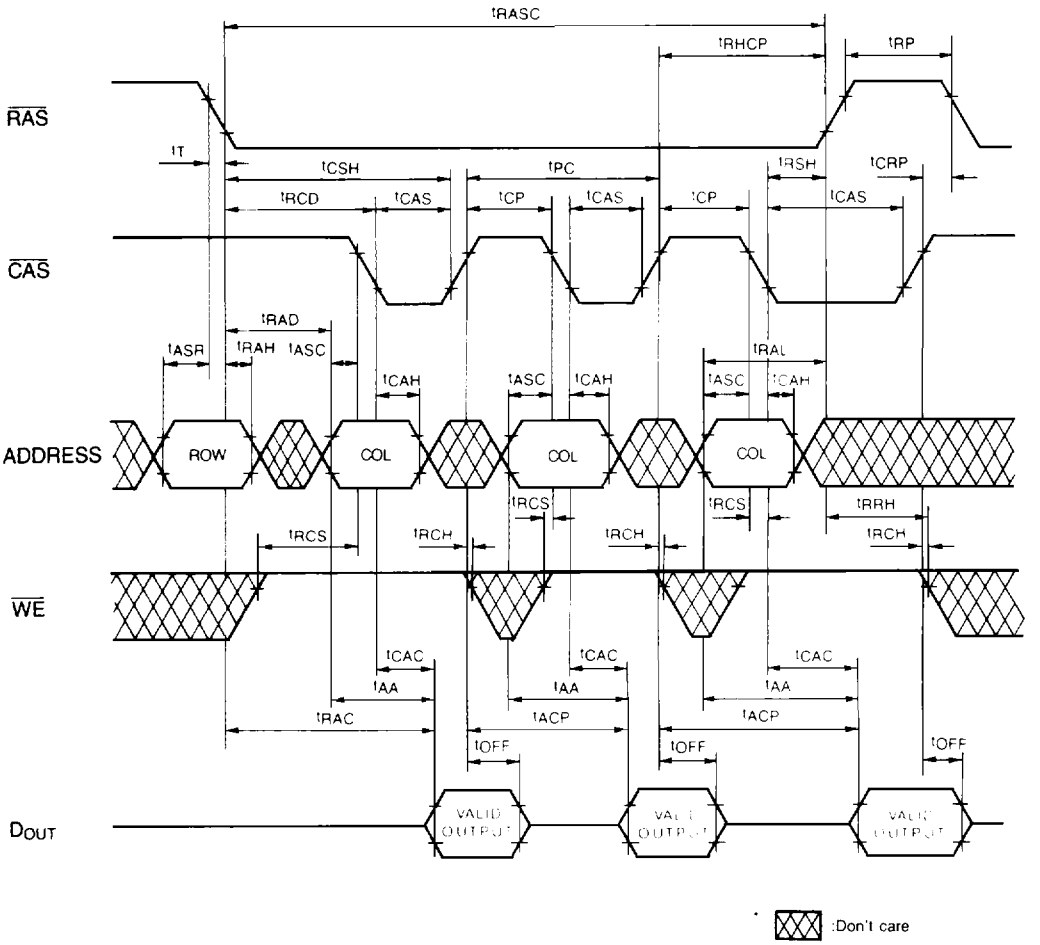


FIGURE 6. FAST PAGE MODE READ CYCLE

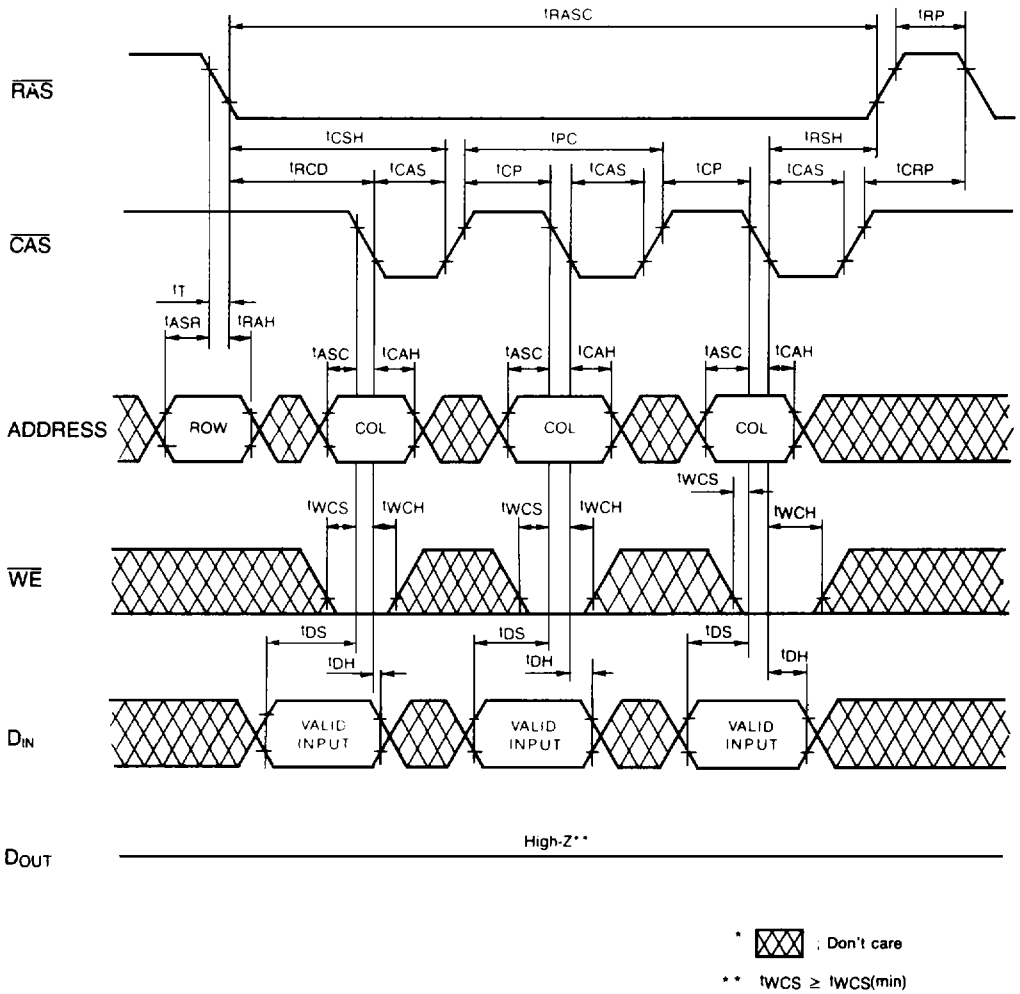
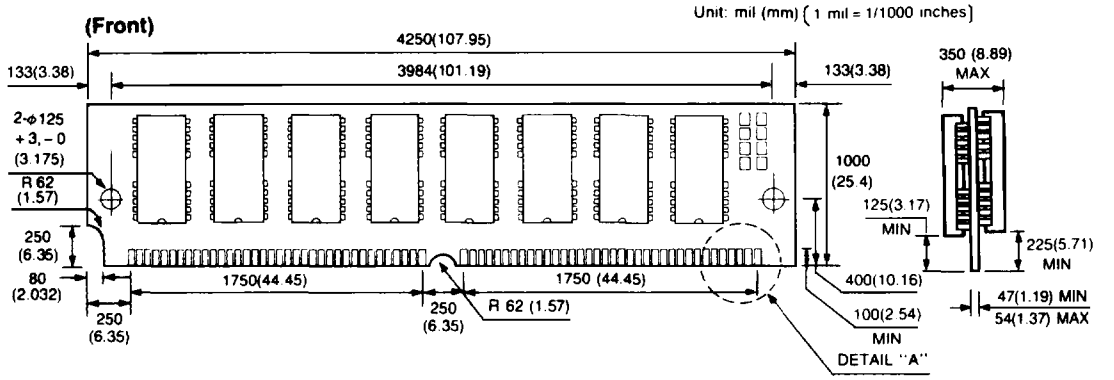


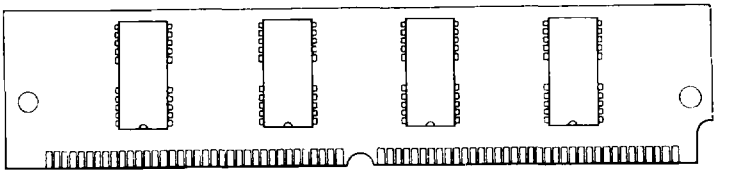
FIGURE 7. FAST PAGE MODE EARLY WRITE CYCLE

Package Dimensions

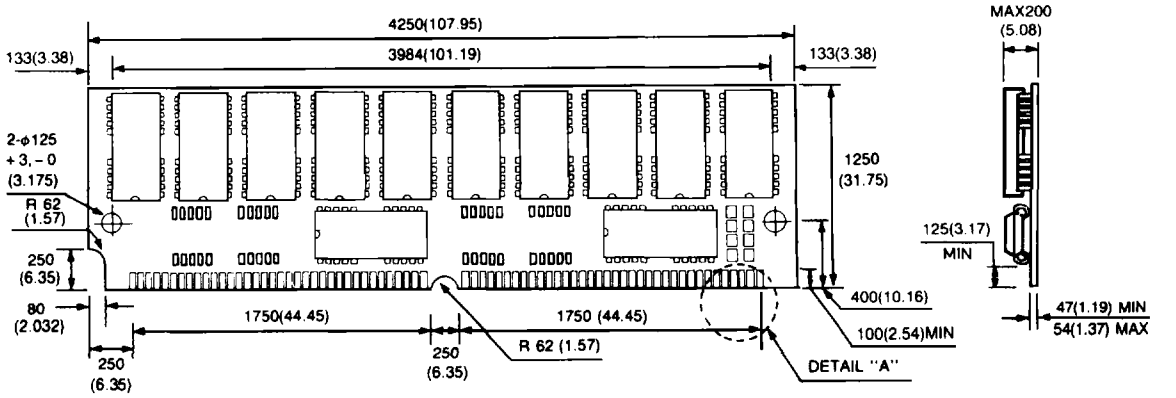
- **GMM7361000BS/BSG**



(Rear)

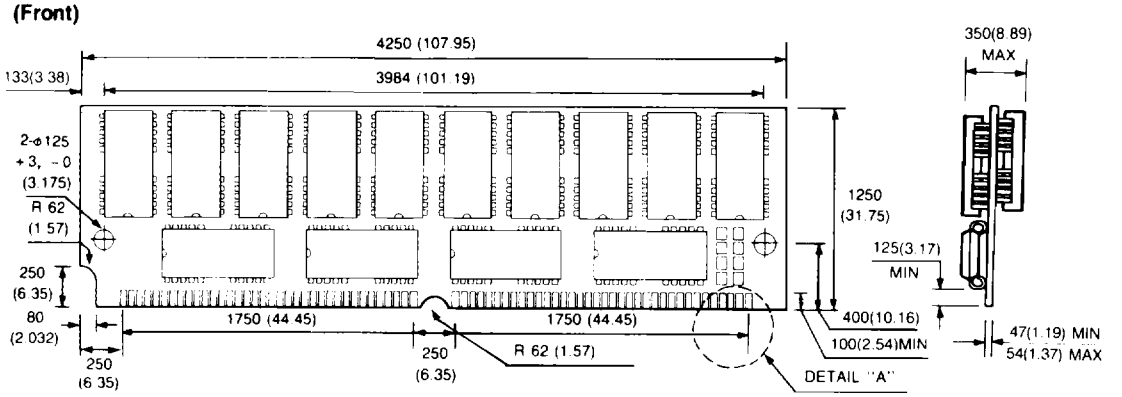


- **GMM7361000BSS/BSGS(There is no component on the rear side)**



- **GMM7362000BS/BSG**

(Front)



(Rear)