



**Flash-ROM Module 16MByte (4Mx32Bit), 72Pin-SIMM, 3.3V Design**  
**Part No. HMF4M32M8VGL**

## GENERAL DESCRIPTION

The HMF4M32M8VGL is a high-speed flash read only memory (FROM) module containing 4,194,304 words organized in a x32bit configuration. The module consists of eight 2M x 8bit FROM mounted on a 72-pin, double -sided, FR4-printed circuit board.

Commands are written to the command register using standard microprocessor write timings.

Register contents serve as input to an internal state-machine, which controls the erase and programming circuitry. Write cycles also internally latch addresses and data needed for the programming and erase operations. Reading data out of the device is similar to reading from 12.0V flash or EPROM devices.

Four chip enable inputs, (/WE0, /WE1, /WE2, /WE3) are used to enable the module's 8 bits independently. Output enable (/OE) and write enable (/WE) can set the memory input and output.

When FROM module is disable condition the module is becoming power standby mode, system designer can get low -power design. All module components may be powered from a single +3.3V DC power supply and all inputs and outputs are TTL-compatible.

## PIN ASSIGNMENT

### FEATURES

- w Access time : 70, 80, 90, 120ns
- w High-density 16MByte design
- w High-reliability, low-power design
- w Single + 3.3V  $\pm$  0.3V power supply
- w Easy memory expansion
- w All inputs and outputs are TTL-compatible
- w FR4-PCB design
- w Low profile 72-pin SIMM
- w Minimum 1,000,000 write/erase cycle
- w Sectors erase architecture
- w Sector group protection
- w Temporary sector group unprotection

### OPTIONS

w Timing

70ns access	-70
80ns access	-80
90ns access	-90
120ns access	-120

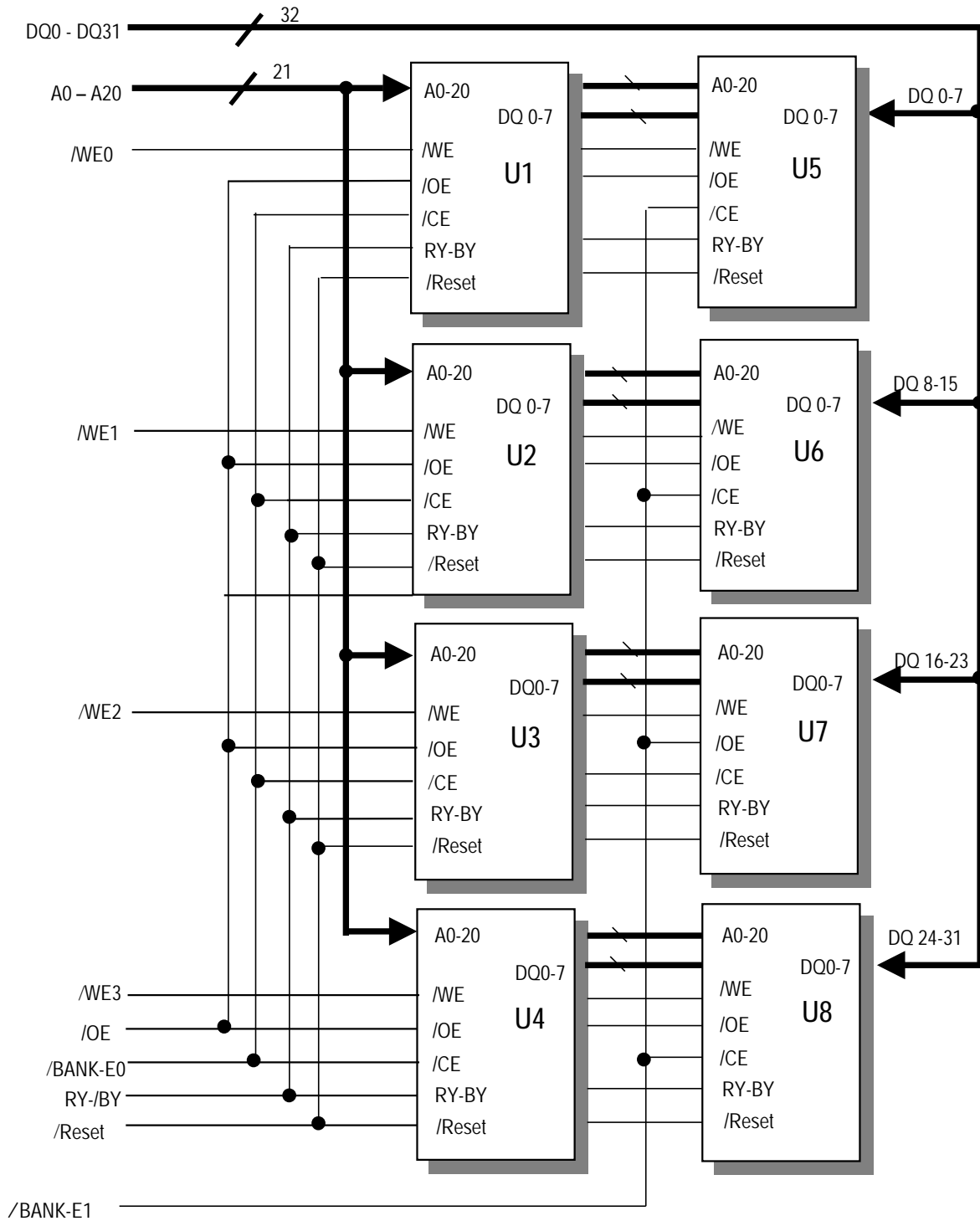
w Packages

72-pin SIMM	M
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### MARKING

PIN	Symbol	PIN	Symbol	PIN	Symbol
1	Vss	25	DQ17	49	/BANKE0
2	NC	26	DQ18	50	A3
3	DQ0	27	DQ19	51	A4
4	DQ1	28	DQ20	52	A5
5	DQ2	29	DQ21	53	A6
6	DQ3	30	Vcc	54	A7
7	DQ4	31	DQ22	55	A8
8	DQ5	32	DQ23	56	A9
9	DQ6	33	/WE2	57	A10
10	Vcc	34	NC	58	A11
11	DQ7	35	DQ24	59	Vcc
12	/WE0	36	DQ25	60	A12
13	/RY_BY	37	DQ26	61	A13
14	DQ8	38	DQ27	62	A14
15	DQ9	39	Vss	63	A15
16	DQ10	40	DQ28	64	A16
17	DQ11	41	DQ29	65	A17
18	DQ12	42	DQ30	66	A18
19	DQ13	43	DQ31	67	A19
20	DQ14	44	/WE3	68	A20
21	DQ15	45	/BANKE1	69	A0
22	/WE1	46	/Reset	70	A1
23	NC	47	A2	71	NC
24	DQ16	48	/OE	72	Vss

FUNCTIONAL BLOCK DIAGRAM



## TRUTH TABLE

MODE	/OE	/CE	/WE	/RESET	DQ ( /BYTE=L )	POWER
STANDBY	X	H	X	V <sub>CC</sub> ±0.3V	HIGH-Z	STANDBY
NOT SELECTED	H	L	H	H	HIGH-Z	ACTIVE
READ	L	L	H	H	D <sub>OUT</sub>	ACTIVE
WRITE or ERASE	X	L	L	H	D <sub>IN</sub>	ACTIVE

NOTE: X means don't care

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING
Voltage with respect to ground all other pins	V <sub>IN,OUT</sub>	-0.5V to V <sub>CC</sub> +0.5V
Voltage with respect to ground V <sub>CC</sub>	V <sub>CC</sub>	-0.5V to +4.0V
Power dissipation	PD	8W
Storage Temperature	T <sub>STG</sub>	-65°C to +150°C
Operating Temperature	T <sub>A</sub>	-55°C to +125°C

w Stresses greater than those listed under " Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operating section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## RECOMMENDED DC OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP.	MAX
V <sub>CC</sub> for ± 10% device Supply Voltages	V <sub>CC</sub>	2.7V		3.6V
Ground	V <sub>SS</sub>	0	0	0

DC AND OPERATING CHARACTERISTICS ( 0°C ≤ T<sub>A</sub> ≤ 70 °C )

PARAMETER	TEST CONDITIONS	SYMBOL	MIN	MAX	UNIT	
Input Load Current	V <sub>CC</sub> =V <sub>CC</sub> max, V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub>	I <sub>L1</sub>		±1.0	μA	
Output Leakage Current	V <sub>CC</sub> =V <sub>CC</sub> max, V <sub>OUT</sub> = V <sub>SS</sub> to V <sub>CC</sub>	I <sub>L0</sub>		±1.0	μA	
Output High Voltage	I <sub>OH</sub> = -2.0mA, V <sub>CC</sub> = V <sub>CC</sub> min	V <sub>OH</sub>	2.4		V	
Output Low Voltage	I <sub>OL</sub> = 4.0mA, V <sub>CC</sub> =V <sub>CC</sub> min	V <sub>OL</sub>		0.45	V	
V <sub>CC</sub> Active Read Current (1)	/CE = V <sub>IL</sub> , /OE = V <sub>IH</sub> ,	I <sub>CC1</sub>	5MHZ	72	128	mA
			1MHZ	16	32	
V <sub>CC</sub> Active Write Current (2)	/CE = V <sub>IL</sub> , /OE=V <sub>IH</sub>	I <sub>CC2</sub>	160	240	mA	
V <sub>CC</sub> Standby Current	/CE, /RESET=V <sub>CC</sub> ±0.3V	I <sub>CC3</sub>		40.0	μA	
Low V <sub>CC</sub> Lock-Out Voltage		V <sub>LKO</sub>	2.3	2.5	V	

Notes: 1. The I<sub>CC</sub> current listed is typically less than 2mA/MHz, with /OE at V<sub>IH</sub>.  
2. I<sub>CC</sub> active while embedded algorithm (program or erase) is in progress

3. Maximum I<sub>cc</sub> current specifications are tested with V<sub>cc</sub>=V<sub>cc max</sub>

## ERASE AND PROGRAMMING PERFORMANCE

PARAMETER	LIMITS			UNIT	COMMENTS
	MIN.	TYP.	MAX.		
Sector Erase Time	-	0.7	15	sec	Excludes 00H programming prior to erasure
Chip Erase Time		25		sec	
Byte Programming Time	-	9	300	μs	Excludes system-level overhead
Chip Programming Time	-	12	36	sec	

## TSOP CAPACITANCE

PARAMETER SYMBOL	PARAMETER DESCRIPTION	TEST SETUP	TYP.	MAX	UNIT
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = 0	6	7.5	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = 0	8.5	12	pF
C <sub>IN2</sub>	Control Pin Capacitance	V <sub>IN</sub> = 0	7.5	9	pF

Notes : Test conditions T<sub>A</sub> = 25° C, f=1.0 MHz.

## AC CHARACTERISTICS

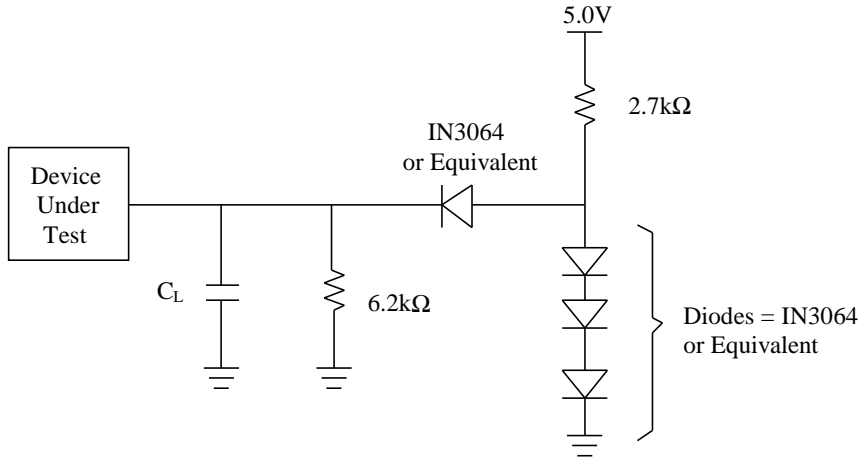
### ⌋ Read Only Operations Characteristics

PARAMETER SYMBOLS		DESCRIPTION	TEST SETUP	Speed Options				UNIT
JEDEC	STANDARD			-70R	-80	-90	-120	
t <sub>AVAV</sub>	t <sub>RC</sub>	Read Cycle Time	Min	70	80	90	120	ns
t <sub>AVQV</sub>	t <sub>ACC</sub>	Address to Output Delay	/CE = V <sub>IL</sub> /OE = V <sub>IL</sub> Max	70	80	90	120	ns
t <sub>ELQV</sub>	t <sub>CE</sub>	Chip Enable to Output Delay	/OE = V <sub>IL</sub> Max	70	80	90	120	ns
t <sub>GLQV</sub>	t <sub>OE</sub>	Output Enable to Output Delay	Max	30	30	35	50	ns
t <sub>EHQZ</sub>	t <sub>DF</sub>	Chip Enable to Output High-Z	Max	25	25	30	30	ns
t <sub>GHQZ</sub>	t <sub>DF</sub>	Output Enable to Output High-Z	Max	25	25	30	30	ns
t <sub>AXQX</sub>	t <sub>QH</sub>	Output Hold Time From Addresses, /CE or /OE, Whichever Occurs First	Min	0				ns

## TEST SPECIFICATIONS

TEST CONDITION	70R, 80	90, 120	UNIT
Output load	1TTL gate		
Output load capacitance, C <sub>L</sub> (Including jig capacitance)	30	100	pF
Input rise and fall times	5		ns
Input pulse levels	0.0-3.0		V

Input timing measurement reference levels	1.5	V
Output timing measurement reference levels	1.5	V



Note :  $C_L = 100\text{pF}$  including jig capacitance

### U Erase/Program Operations

PARAMETER SYMBOLS		DESCRIPTION		Speed Options				UNIT
JEDEC	STANDARD			70R	80	90	120	
$t_{AVAV}$	$t_{WC}$	Write Cycle Time	Min	70	80	90	120	ns
$t_{AVWL}$	$t_{AS}$	Address Setup Time	Min	0				ns
$t_{WLAX}$	$t_{AH}$	Address Hold Time	Min	45	45	45	50	ns
$t_{DVWH}$	$t_{DS}$	Data Setup Time	Min	35	35	45	50	ns
$t_{WHDX}$	$t_{DH}$	Data Hold Time	Min	0				ns
	$t_{OES}$	Output Enable Setup Time	Min	0				ns
$t_{GHWL}$	$t_{GHWL}$	Read Recovery Time Before Write	Min	0				ns
$t_{ELWL}$	$t_{CS}$	/CE Setup Time	Min	0				ns
$t_{WHEH}$	$t_{CH}$	/CE Hold Time	Min	0				ns
$t_{WLWH}$	$t_{WP}$	Write Pulse Width	Min	35	35	35	50	ns
$t_{WHWL}$	$t_{WPH}$	Write Pulse Width High	Min	30				ns
$t_{WHWH1}$	$t_{WHWH1}$	Byte Programming Operation	Typ	9				$\mu\text{s}$
$t_{WHWH2}$	$t_{WHWH2}$	Sector Erase Operation (Note1)	Typ	0.7				sec
	$t_{VCS}$	Vcc set up time	Min	50				$\mu\text{s}$

- Notes :
- 1 . This does not include the preprogramming time
  - 2 . This timing is only for Sector Protect operations

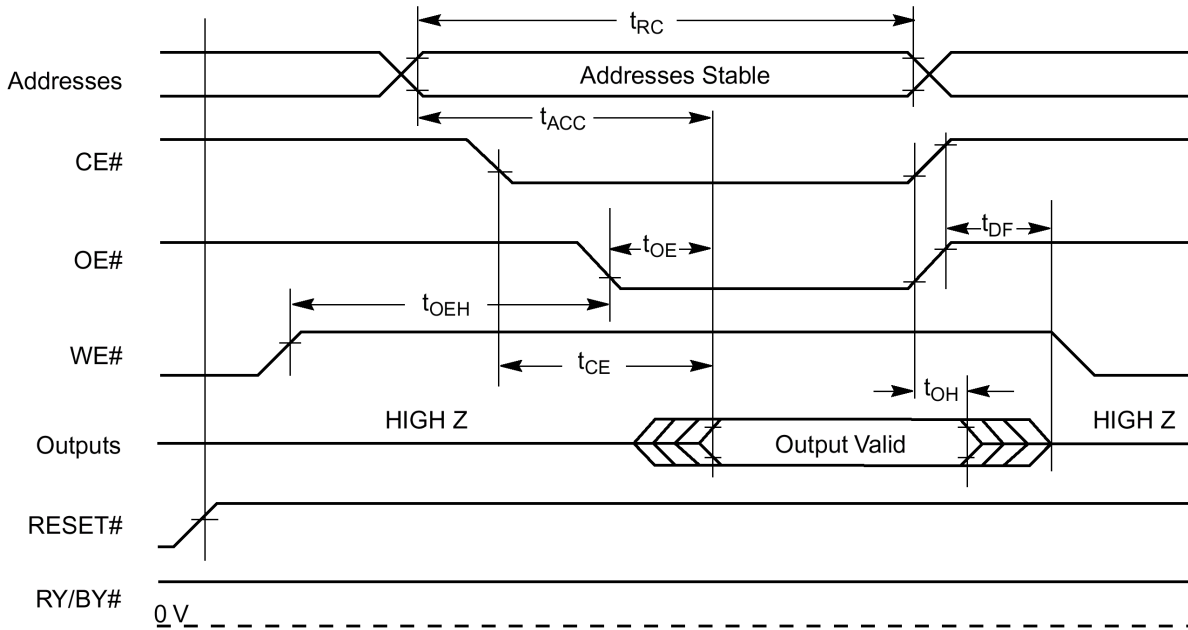
## Eraser/Program Operations

### Alternate /CE Controlled Writes

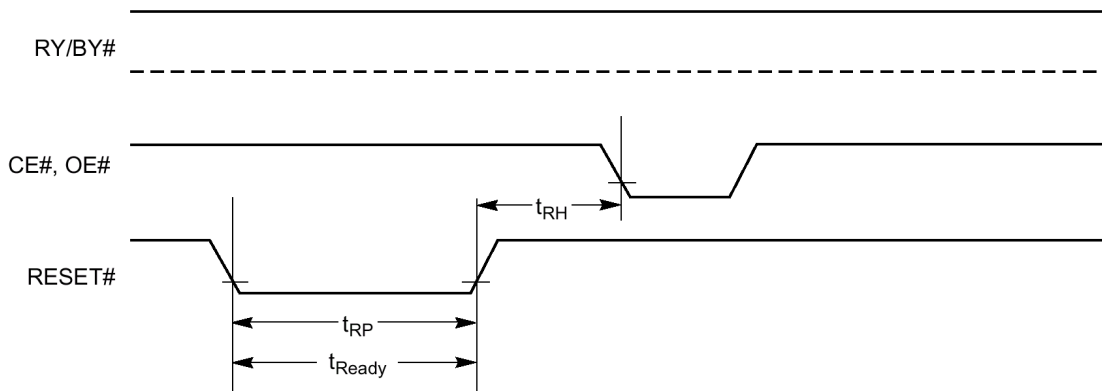
PARAMETER SYMBOLS		DESCRIPTION		Speed Options				UNIT
JEDEC	STANDARD			-70R	-80	-90	120	
t <sub>AVAV</sub>	t <sub>WC</sub>	Write Cycle Time	Min	70	80	90	120	ns
t <sub>AVWL</sub>	t <sub>AS</sub>	Address Setup Time	Min	0				ns
t <sub>WLAX</sub>	t <sub>AH</sub>	Address Hold Time	Min	45	45	45	50	ns
t <sub>DVWH</sub>	t <sub>DS</sub>	Data Setup Time	Min	35	35	45	50	ns
t <sub>WHDX</sub>	t <sub>DH</sub>	Data Hold Time	Min	0				ns
	t <sub>OES</sub>	Output Enable Setup Time	Min	0				ns
t <sub>GHWL</sub>	t <sub>GHWL</sub>	Read Recovery Time Before Write	Min	0				ns
t <sub>ELWL</sub>	t <sub>CS</sub>	/CE Setup Time	Min	0				ns
t <sub>WHEH</sub>	t <sub>CH</sub>	/CE Hold Time	Min	0				ns
t <sub>WLWH</sub>	t <sub>WP</sub>	Write Pulse Width	Min	35	35	35	50	ns
t <sub>WHWL</sub>	t <sub>WPH</sub>	Write Pulse Width High	Min	30				ns
t <sub>WHWH1</sub>	t <sub>WHWH1</sub>	Byte Programming Operation	Typ	9				μs
t <sub>WHWH2</sub>	t <sub>WHWH2</sub>	Sector Erase Operation (Note1)	Typ	0.7				sec

- Notes :**
1. This does not include the preprogramming time
  2. This timing is only for Sector Protect operations

U READ OPERATIONS TIMING

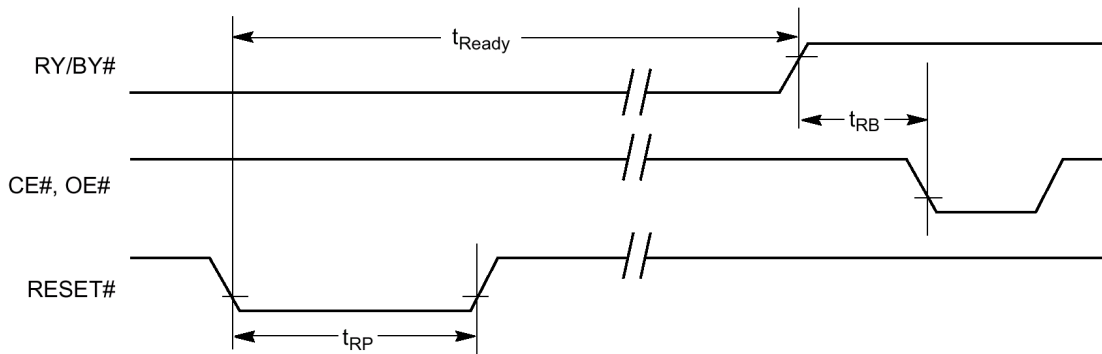


U RESET TIMING

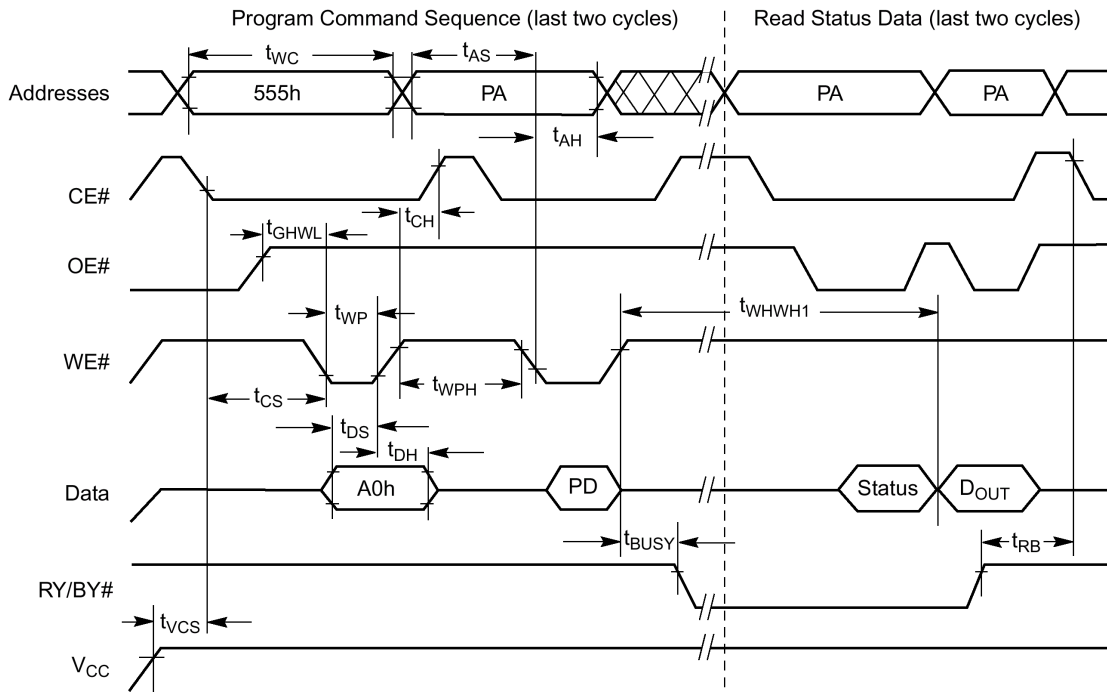


Reset Timings NOT during Embedded Algorithms

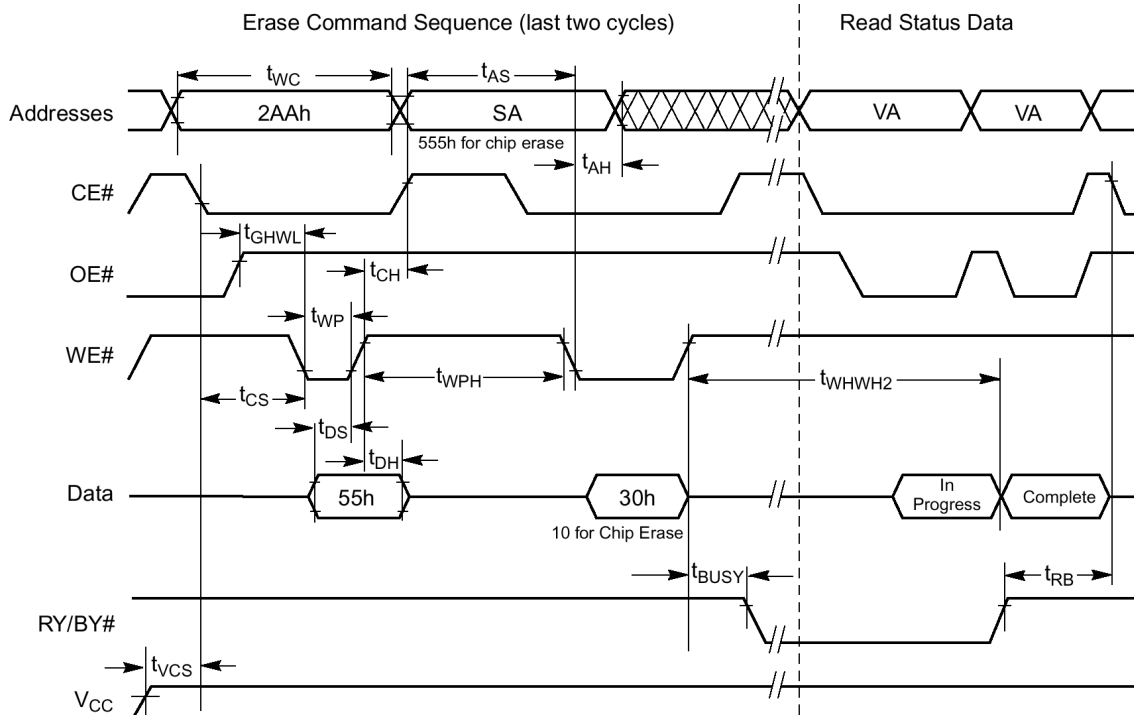
Reset Timings during Embedded Algorithms



U PROGRAM OPERATIONS TIMING

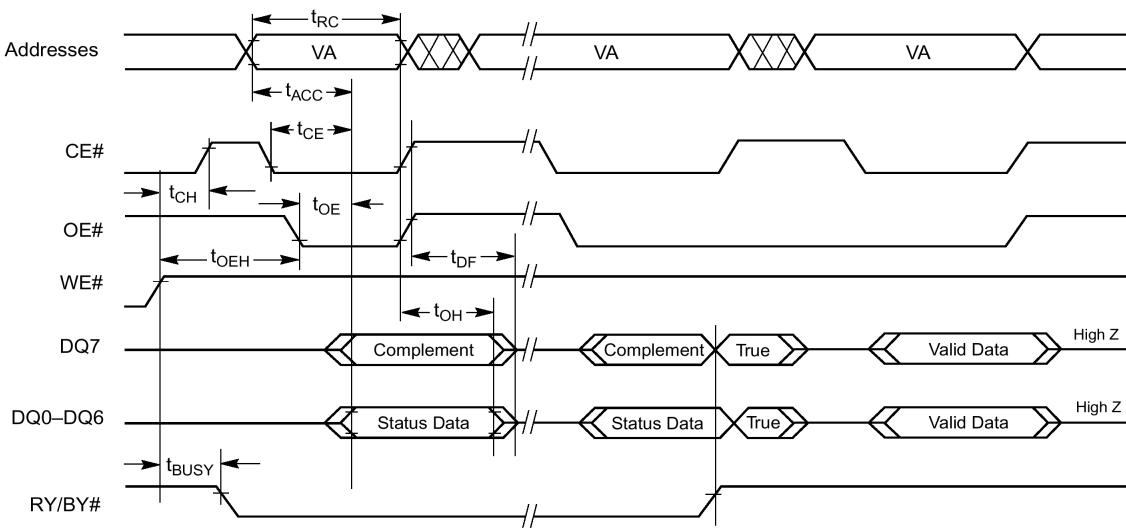


U CHIP/SECTOR ERASE OPERATION TIMINGS

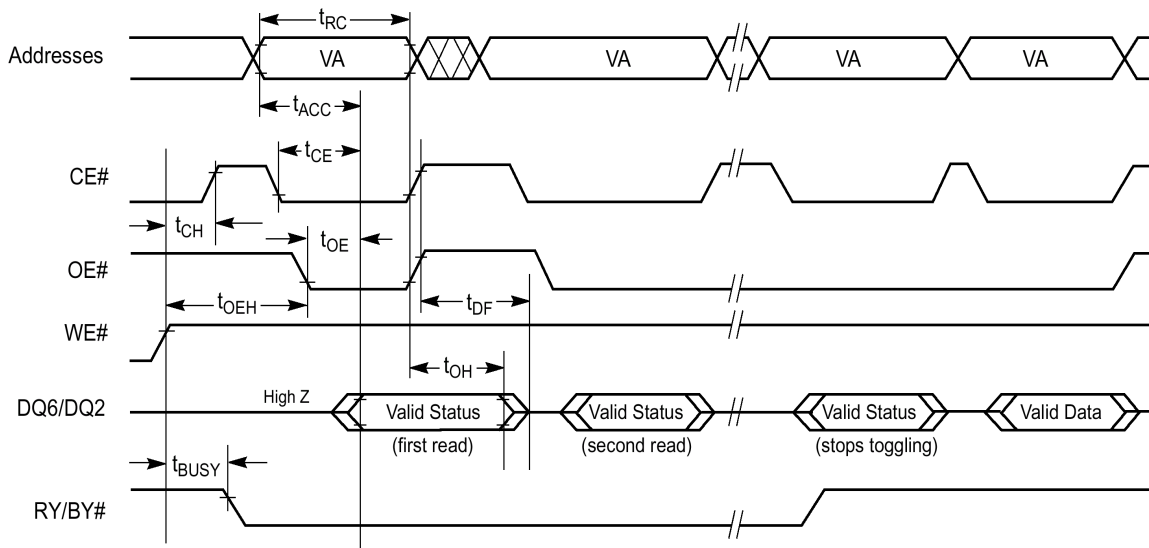




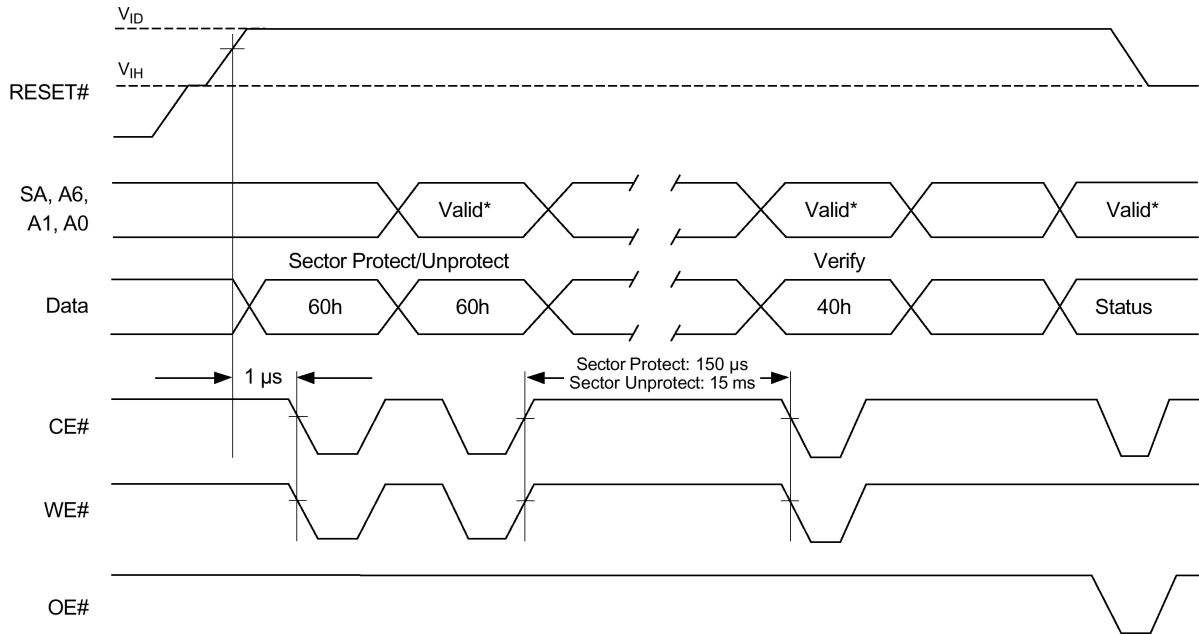
**U DATA# POLLING TIMES(DURING EMBEDDED ALGORITHMS)**



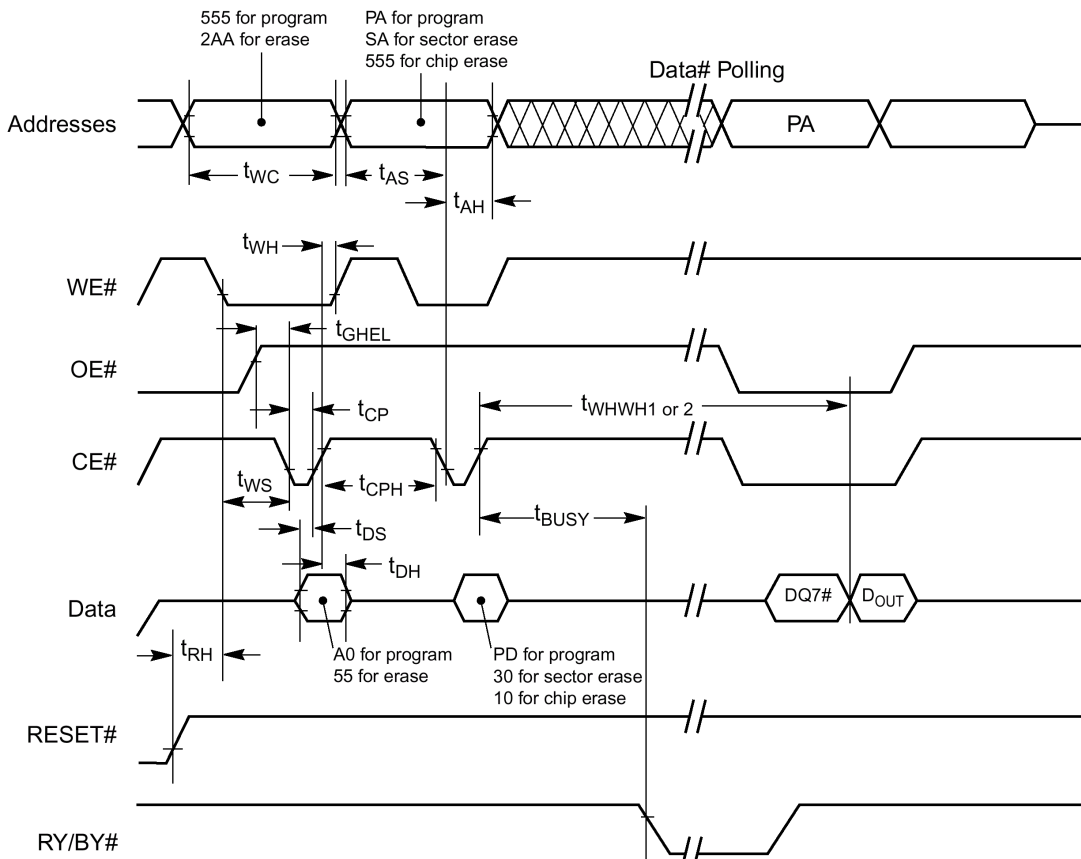
**U TOGGLE# BIT TIMINGS (DURING EMBEDDED ALGORITHMS)**



U SECTOR PROTECT UNPROTECT TIMEING DIAGRAM

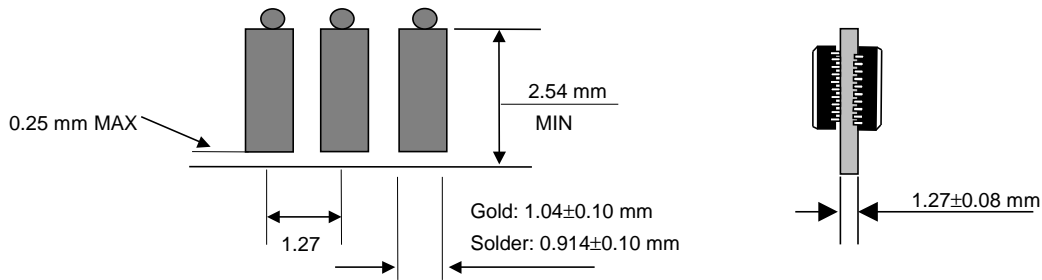
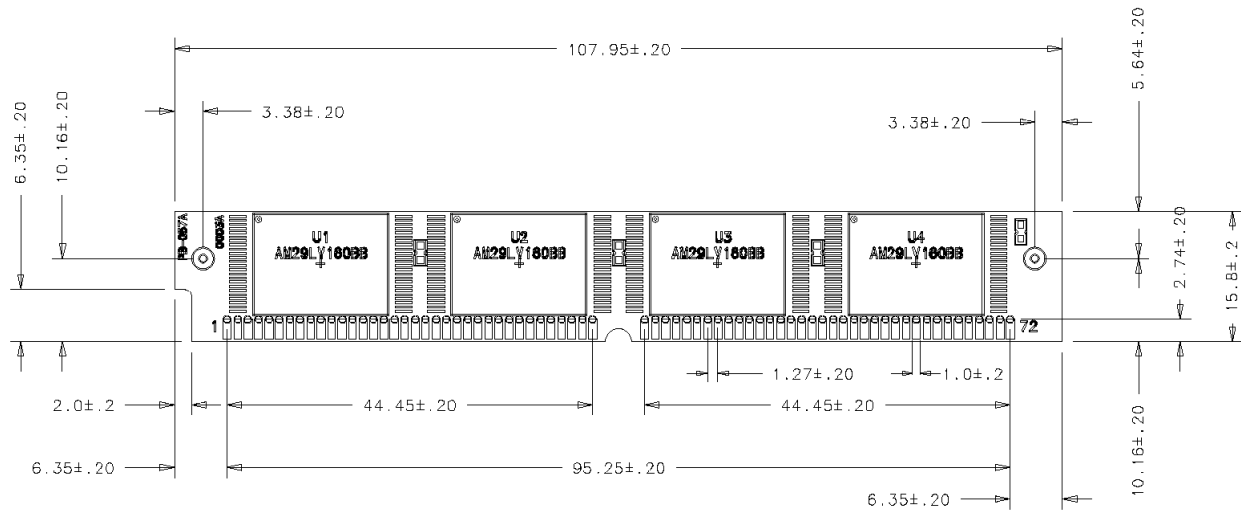


U ALTERNATE  $CE\#$  CONTROLLED WRITE OPERATING TIMINGS



**PACKAGE DIMENSIONS**

(UNIT : mm)



(Solder & Gold Plating)

**ORDERING INFORMATION**

Part Number	Density	Org.	Package	Component Number	Vcc	SPEED
HMF4M32M8VGL-70	16MByte	4Mx 32bit	72Pin -SIMM	8EA	3.3V	70ns
HMF4M32M8VGL-80	16MByte	4Mx 32bit	72Pin -SIMM	8EA	3.3V	80ns
HMF4M32M8VGL-90	16MByte	4Mx 32bit	72Pin -SIMM	8EA	3.3V	90ns
HMF4M32M8VGL-120	16MByte	4Mx 32bit	72Pin -SIMM	8EA	3.3V	120ns