

Stacked MCP (Multi-Chip Package) FLASH MEMORY & SRAM  
CMOS

# 16M (×8/×16) FLASH MEMORY & 2M (×8/×16) STATIC RAM

## MB84VD2108XEM-70/MB84VD2109XEM-70

### ■ FEATURES

- Power Supply Voltage of 2.7 V to 3.3 V
- High Performance
  - 70 ns maximum access time (Flash)
  - 70 ns maximum access time (SRAM)
- Operating Temperature
  - 40 °C to +85 °C
- Package 56-ball BGA

(Continued)

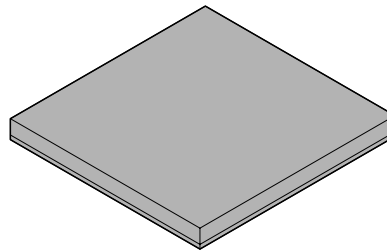
### ■ PRODUCT LINE UP

Part No.	MB84VD2108XEM/MB84VD2109XEM	
Supply Voltage(V)	$V_{ccf} = 3.0 \text{ V} \begin{matrix} +0.3 \text{ V} \\ -0.3 \text{ V} \end{matrix}$	$V_{ccs} = 3.0 \text{ V} \begin{matrix} +0.3 \text{ V} \\ -0.3 \text{ V} \end{matrix}$
Max Address Access Time (ns)	70	70
Max $\overline{\text{CE}}$ Access Time (ns)	70	70
Max $\overline{\text{OE}}$ Access Time (ns)	30	35

Note: Both  $V_{ccf}$  and  $V_{ccs}$  must be in recommended operation range when either part is being accessed.

### ■ PACKAGE

56-ball plastic BGA



(BGA-56P-M02)

# MB84VD2108XEM/2109XEM-70

(Continued)

## • FLASH MEMORY

### • Simultaneous Read/Write Operations (Dual Bank)

Multiple devices available with different bank sizes (Please refer to ORDERING INFORMATION)

Host system can program or erase in one bank, then immediately and simultaneously read from the other bank

Zero latency between read and write operations

Read-while-erase

Read-while-program

### • Minimum 100,000 Write/Erase Cycles

### • Sector Erase Architecture

Eight 4 K words and thirty one 32 K words.

Any combination of sectors can be concurrently erased. Also supports full chip erase.

### • Boot Code Sector Architecture

MB84VD2108XEM: Top sector

MB84VD2109XEM: Bottom sector

### • Embedded Erase™\* Algorithms

Automatically pre-programs and erases the chip or any sector

### • Embedded Program™\* Algorithms

Automatically writes and verifies data at specified address

### • Data Polling and Toggle Bit Feature for Detection of Program or Erase Cycle Completion

### • Ready-Busy Output (RY/BY)

Hardware method for detection of program or erase cycle completion

### • Automatic Sleep Mode

When addresses remain stable, automatically switch themselves to low power mode.

### • Low V<sub>CC</sub> Write Inhibit ≤ 2.5 V

### • HiddenROM Region

64K byte of HiddenROM, accessible through a new “HiddenROM Enable” command sequence

Factory serialized and protected to provide a secure electronic serial number (ESN)

### • WP/ACC Input Pin

At V<sub>IL</sub>, allows protection of boot sectors, regardless of sector protection/unprotection status

(MB84VD2108XEM:SA37,SA38 MB84VD2109XEM:SA0,SA1)

At V<sub>IH</sub>, allows removal of boot sector protection

At V<sub>ACC</sub>, program time will reduce by 40%.

### • Erase Suspend/Resume

Suspends the erase operation to allow a read in another sector within the same device

### • Please refer to “MBM29DL16XTE/BE” Datasheet in Detailed Function

\* : Embedded Erase™ and Embedded Program™ are trademarks of Advanced Micro Devices, Inc.

## • SRAM

### • Power Dissipation

Operating : 40 mA Max

Standby : 7 μA Max

### • Power Down Features using $\overline{CE1}$ s and CE2s

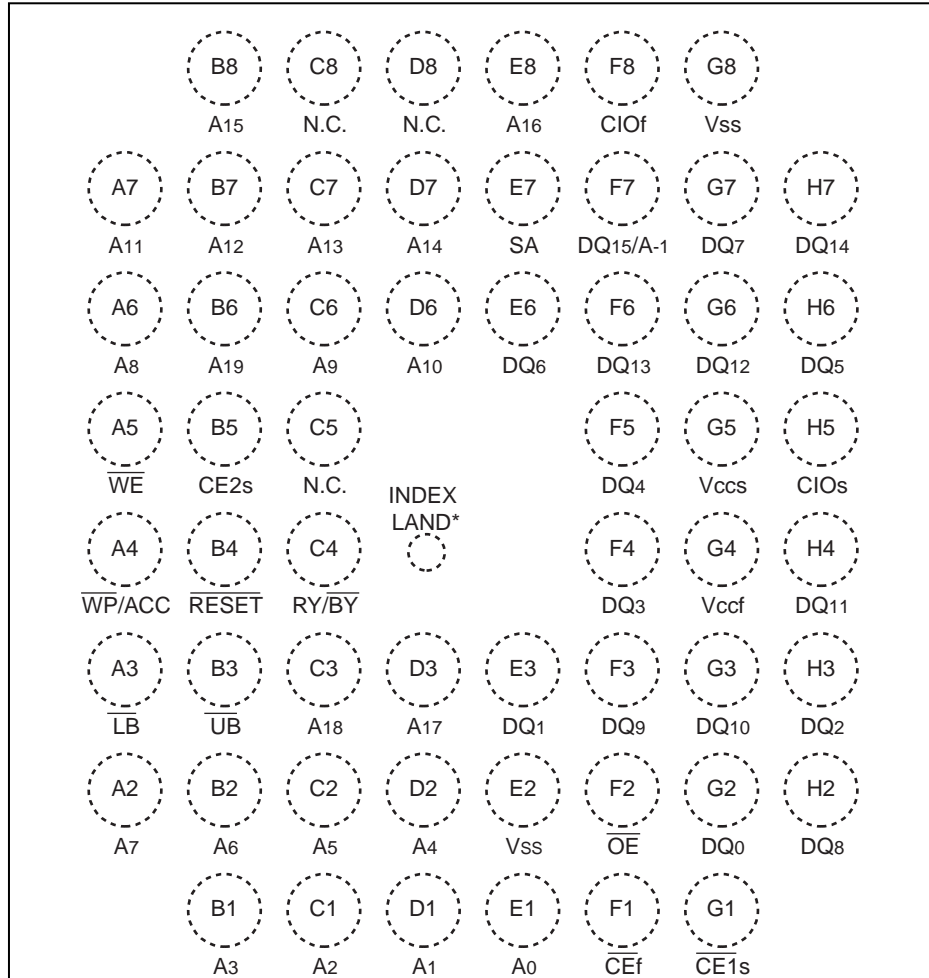
### • Data Retention Supply Voltage: 1.5 V to 3.3 V

### • $\overline{CE1}$ s and CE2s Chip Select

### • Byte Data Control: $\overline{LB}$ (DQ<sub>7</sub> to DQ<sub>0</sub>), $\overline{UB}$ (DQ<sub>15</sub> to DQ<sub>8</sub>)

## ■ PIN ASSIGNMENT

(Top View)  
Marking side



\* : There is no solder ball. This land should be open electrically.

(BGA-56P-M02)

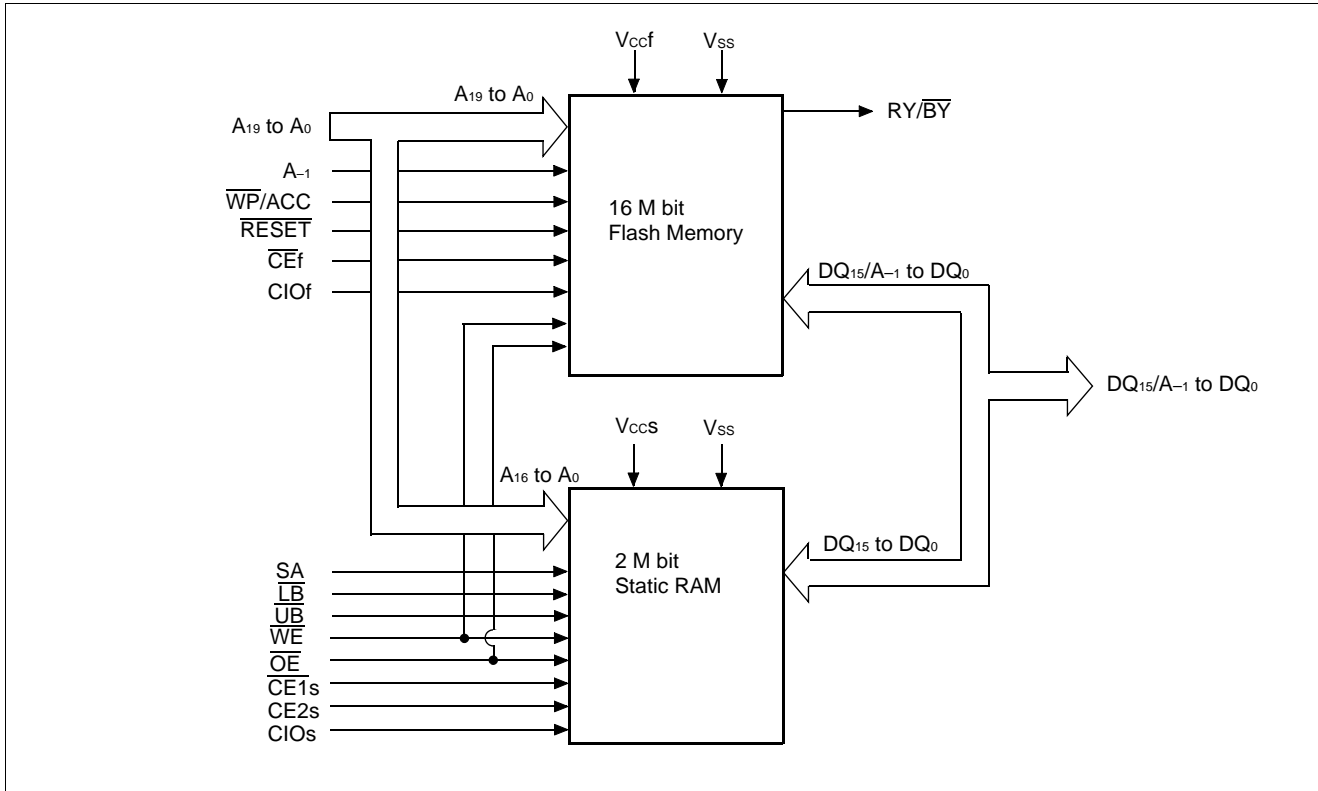
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## ■ PIN DESCRIPTION

Pin Name	Function	Input/Output
A <sub>16</sub> to A <sub>0</sub>	Address Inputs (Common)	I
A <sub>19</sub> to A <sub>17</sub> , A <sub>-1</sub>	Address Input (Flash)	I
SA	Address Input (SRAM)	I
DQ <sub>15</sub> to DQ <sub>0</sub>	Data Inputs / Outputs (Common)	I/O
$\overline{\text{CE}}_f$	Chip Enable (Flash)	I
$\overline{\text{CE}}_{1s}$	Chip Enable (SRAM)	I
CE <sub>2s</sub>	Chip Enable (SRAM)	I
$\overline{\text{OE}}$	Output Enable (Common)	I
$\overline{\text{WE}}$	Write Enable (Common)	I
RY/ $\overline{\text{BY}}$	Ready/Busy Outputs (Flash) Open Drain Output	O
$\overline{\text{UB}}$	Upper Byte Control (SRAM)	I
$\overline{\text{LB}}$	Lower Byte Control (SRAM)	I
CIO <sub>f</sub>	I/O Configuration (Flash) CIO <sub>f</sub> =V <sub>ccf</sub> is Word mode ( ×16), CIO <sub>f</sub> =V <sub>ss</sub> is Byte mode ( × 8)	I
CIO <sub>s</sub>	I/O Configuration (SRAM) CIO <sub>s</sub> =V <sub>ccs</sub> is Word mode ( ×16), CIO <sub>s</sub> =V <sub>ss</sub> is Byte mode ( × 8)	I
$\overline{\text{RESET}}$	Hardware Reset Pin / Sector Protection Un- lock (Flash)	I
$\overline{\text{WP/ACC}}$	Write Protect / Acceleration (Flash)	I
N.C.	No Internal Connection	—
V <sub>ss</sub>	Device Ground (Common)	Power
V <sub>ccf</sub>	Device Power Supply (Flash)	Power
V <sub>ccs</sub>	Device Power Supply (SRAM)	Power

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## ■ BLOCK DIAGRAM



# MB84VD2108XEM/2109XEM-70

## ■ DEVICE BUS OPERATIONS

User Bus Operations Table (Flash = Word mode; CIO<sub>f</sub> = V<sub>ccf</sub>, SRAM = Word mode; CIO<sub>s</sub> = V<sub>ccs</sub>)

Operation *1, *3	$\overline{CEf}$	$\overline{CE1s}$	CE2s	$\overline{OE}$	$\overline{WE}$	SA	$\overline{LB}$	$\overline{UB}$	DQ <sub>7</sub> to DQ <sub>0</sub>	DQ <sub>15</sub> to DQ <sub>8</sub>	$\overline{RESET}$	$\overline{WP/ACC}$ *5
Full Standby	H	H	X	X	X	X	X	X	High-Z	High-Z	H	X
		X	L									
Output Disable	H	L	H	H	H	X	X	X	High-Z	High-Z	H	X
				X	X	X	H	H	High-Z	High-Z		
	L	H	X	H	H	X	X	X	High-Z	High-Z		
		X	L									
Read from Flash *2	L	H	X	L	H	X	X	X	D <sub>OUT</sub>	D <sub>OUT</sub>	H	X
			X						L			
Write to Flash	L	H	X	H	L	X	X	X	D <sub>IN</sub>	D <sub>IN</sub>	H	X
			X						L			
Read from SRAM	H	L	H	L	H	X	L	L	D <sub>OUT</sub>	D <sub>OUT</sub>	H	X
							H	L	High-Z	D <sub>OUT</sub>		
							L	H	D <sub>OUT</sub>	High-Z		
Write to SRAM	H	L	H	X	L	X	L	L	D <sub>IN</sub>	D <sub>IN</sub>	H	X
							H	L	High-Z	D <sub>IN</sub>		
							L	H	D <sub>IN</sub>	High-Z		
Temporary Sector Group Unprotection *4	X	X	X	X	X	X	X	X	X	X	V <sub>ID</sub>	X
Flash Hardware Reset	X	H	X	X	X	X	X	X	High-Z	High-Z	L	X
		X	L									
Boot Block Sector Write Protection	X	X	X	X	X	X	X	X	X	X	X	L

Legend: L = V<sub>IL</sub>, H = V<sub>IH</sub>, X = V<sub>IL</sub> or V<sub>IH</sub>. See DC Characteristics for voltage levels.

\*1 : Other operations except for indicated this column are inhibited.

\*2 :  $\overline{WE}$  can be V<sub>IL</sub> if  $\overline{OE}$  is V<sub>IL</sub>,  $\overline{OE}$  at V<sub>IH</sub> initiates the write operations.

\*3 : Do not apply  $\overline{CEf} = V_{IL}$ ,  $\overline{CE1s} = V_{IL}$  and CE2s = V<sub>IH</sub> at a time.

\*4 : It is also used for the extended sector group protections.

\*5 :  $\overline{WP/ACC} = V_{IL}$ ; protection of boot sectors.

$\overline{WP/ACC} = V_{IH}$ ; removal of boot sectors protection.

$\overline{WP/ACC} = V_{ACC}$  (9 V); Program time will reduce by 40%.

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User Bus Operations Table (Flash = Word mode; CIO<sub>f</sub> = V<sub>ccf</sub>, SRAM = Byte mode; CIO<sub>s</sub> = V<sub>ss</sub>)

Operation *1, *3	$\overline{CE}_f$	$\overline{CE}_{1s}$	CE <sub>2s</sub>	$\overline{OE}$	$\overline{WE}$	SA	$\overline{LB}$	$\overline{UB}$	DQ <sub>7</sub> to DQ <sub>0</sub>	DQ <sub>15</sub> to DQ <sub>8</sub>	$\overline{RESET}$	$\overline{WP}/ACC$ *5
Full Standby	H	H	X	X	X	X	X	X	High-Z	High-Z	H	X
		X	L									
Output Disable	H	L	H	H	H	X	X	X	High-Z	High-Z	H	X
				X	X	X	H	H	High-Z	High-Z		
	L	H	X	H	H	X	X	X	High-Z	High-Z		
X											L	
Read from Flash *2	L	H	X	L	H	X	X	X	D <sub>OUT</sub>	D <sub>OUT</sub>	H	X
		X	L									
Write to Flash	L	H	X	H	L	X	X	X	D <sub>IN</sub>	D <sub>IN</sub>	H	X
		X	L									
Read from SRAM	H	L	H	L	H	SA	X	X	D <sub>OUT</sub>	High-Z	H	X
Write to SRAM	H	L	H	X	L	SA	X	X	D <sub>IN</sub>	High-Z	H	X
Temporary Sector Group Unprotection *4	X	X	X	X	X	X	X	X	X	X	V <sub>ID</sub>	X
Flash Hardware Reset	X	H	X	X	X	X	X	X	High-Z	High-Z	L	X
		X	L									
Boot Block Sector Write Protection	X	X	X	X	X	X	X	X	X	X	X	L

Legend: L = V<sub>IL</sub>, H = V<sub>IH</sub>, X = V<sub>IL</sub> or V<sub>IH</sub>. See DC Characteristics for voltage levels.

\*1 : Other operations except for indicated this column are inhibited.

\*2 :  $\overline{WE}$  can be V<sub>IL</sub> if  $\overline{OE}$  is V<sub>IL</sub>,  $\overline{OE}$  at V<sub>IH</sub> initiates the write operations.

\*3 : Do not apply  $\overline{CE}_f = V_{IL}$ ,  $\overline{CE}_{1s} = V_{IL}$  and CE<sub>2s</sub> = V<sub>IH</sub> at a time.

\*4 : It is also used for the extended sector group protections.

\*5 :  $\overline{WP}/ACC = V_{IL}$ ; protection of boot sectors.

$\overline{WP}/ACC = V_{IH}$ ; removal of boot sectors protection.

$\overline{WP}/ACC = V_{ACC}$  (9 V); Program time will reduce by 40%.

# MB84VD2108XEM/2109XEM-70

User Bus Operations Table (Flash = Byte mode; CIO<sub>f</sub> = V<sub>SS</sub>, SRAM = Byte mode; CIO<sub>s</sub> = V<sub>SS</sub>)

Operation *1,*3	$\overline{CEf}$	$\overline{CE1s}$	$CE2s$	$DQ_{15}/A_{-1}$	$\overline{OE}$	$\overline{WE}$	SA	$\overline{LB}$	$\overline{UB}$	DQ <sub>7</sub> to DQ <sub>0</sub>	DQ <sub>14</sub> to DQ <sub>8</sub>	$\overline{RESET}$	$\overline{WP/ACC}$ *5
Full Standby	H	H	X	X	X	X	X	X	X	High-Z	High-Z	H	X
		X	L										
Output Disable	H	L	H	X	H	H	X	X	X	High-Z	High-Z	H	X
				X	X	X	H	H	High-Z	High-Z			
	L	H	X	A <sub>-1</sub>	H	H	X	X	X	High-Z	High-Z		
Read from Flash *2	L	H	X	A <sub>-1</sub>	L	H	X	X	X	D <sub>OUT</sub>	High-Z	H	X
		X	L										
Write to Flash	L	H	X	A <sub>-1</sub>	H	L	X	X	X	D <sub>IN</sub>	High-Z	H	X
		X	L										
Read from SRAM	H	L	H	X	L	H	SA	X	X	D <sub>OUT</sub>	High-Z	H	X
Write to SRAM	H	L	H	X	X	L	SA	X	X	D <sub>IN</sub>	High-Z	H	X
Temporary Sector Group Unprotection *4	X	X	X	X	X	X	X	X	X	X	X	V <sub>ID</sub>	X
Flash Hardware Reset	X	H	X	X	X	X	X	X	X	High-Z	High-Z	L	X
		X	L										
Boot Block Sector Write Protection	X	X	X	X	X	X	X	X	X	X	X	X	L

Legend: L = V<sub>IL</sub>, H = V<sub>IH</sub>, X = V<sub>IL</sub> or V<sub>IH</sub>. See DC Characteristics for voltage levels.

\*1 : Other operations except for indicated this column are inhibited.

\*2 :  $\overline{WE}$  can be V<sub>IL</sub> if  $\overline{OE}$  is V<sub>IL</sub>,  $\overline{OE}$  at V<sub>IH</sub> initiates the write operations.

\*3 : Do not apply  $\overline{CEf}$  = V<sub>IL</sub>,  $\overline{CE1s}$  = V<sub>IL</sub> and  $CE2s$  = V<sub>IH</sub> at a time.

\*4 : It is also used for the extended sector group protections.

\*5 :  $\overline{WP/ACC}$  = V<sub>IL</sub>; protection of boot sectors.

$\overline{WP/ACC}$  = V<sub>IH</sub>; removal of boot sectors protection.

$\overline{WP/ACC}$  = V<sub>ACC</sub> (9 V); Program time will reduce by 40%.



## ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min	Max	
Storage Temperature	T <sub>stg</sub>	-55	+125	°C
Ambient Temperature with Power Applied	T <sub>A</sub>	-40	+85	°C
Voltage with Respect to Ground All pins except $\overline{\text{RESET}}$ , $\overline{\text{WP/ACC}}$ *1	V <sub>IN</sub> , V <sub>OUT</sub>	-0.3	V <sub>ccf</sub> +0.4	V
			V <sub>ccs</sub> +0.4	V
V <sub>ccf</sub> /V <sub>ccs</sub> Supply *1	V <sub>ccf</sub> , V <sub>ccs</sub>	-0.3	+4.0	V
$\overline{\text{RESET}}$ *2	V <sub>IN</sub>	-0.5	+ 13.0	V
$\overline{\text{WP/ACC}}$ *3	V <sub>IN</sub>	-0.5	+10.5	V

\*1 : Minimum DC voltage on input or I/O pins is -0.3 V. During voltage transitions, input or I/O pins may undershoot V<sub>SS</sub> to -2.0 V for periods of up to 20 ns. Maximum DC voltage on input or I/O pins is V<sub>ccf</sub>+0.4 V or V<sub>ccs</sub>+0.4 V. During voltage transitions, input or I/O pins may overshoot to V<sub>ccf</sub>+2.0 V or V<sub>ccs</sub>+2.0 V for periods of up to 20 ns.

\*2 : Minimum DC input voltage on  $\overline{\text{RESET}}$  pin is -0.5 V. During voltage transitions,  $\overline{\text{RESET}}$  pins may undershoot V<sub>SS</sub> to -2.0 V for periods of up to 20 ns. Voltage difference between input and supply voltage (V<sub>IN</sub>-V<sub>ccf</sub> or V<sub>ccs</sub>) does not exceed +9.0 V. Maximum DC input voltage on  $\overline{\text{RESET}}$  pins is +13.0 V which may overshoot to +14.0 V for periods of up to 20 ns.

\*3 : Minimum DC input voltage on  $\overline{\text{WP/ACC}}$  pin is -0.5 V. During voltage transitions,  $\overline{\text{WP/ACC}}$  pin may undershoot V<sub>SS</sub> to -2.0 V for periods of up to 20 ns. Maximum DC input voltage on  $\overline{\text{WP/ACC}}$  pin is +10.5 V which may overshoot to +12.0 V for periods of up to 20 ns, when V<sub>ccf</sub> is applied.

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

## ■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value		Unit
		Min	Max	
Ambient Temperature	T <sub>A</sub>	-40	+85	°C
V <sub>ccf</sub> /V <sub>ccs</sub> Supply Voltages	V <sub>ccf</sub> , V <sub>ccs</sub>	+2.7	+3.3	V

Note: Operating ranges define those limits between which the functionality of the device is guaranteed.

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

# MB84VD2108XEM/2109XEM-70

## ■ ELECTRICAL CHARACTERISTICS

### 1. DC Characteristics

Parameter	Symbol	Test Conditions	Value			Unit		
			Min	Typ	Max			
Input Leakage Current	$I_{LI}$	$V_{IN} = V_{SS} \text{ to } V_{CCf}, V_{CCS}$	-1.0	—	+1.0	$\mu\text{A}$		
Output Leakage Current	$I_{LO}$	$V_{OUT} = V_{SS} \text{ to } V_{CCf}, V_{CCS}$	-1.0	—	+1.0	$\mu\text{A}$		
$\overline{\text{RESET}}$ Inputs Leakage Current	$I_{LIT}$	$V_{CCf} = V_{CCf} \text{ Max}, V_{CCS} = V_{CCS} \text{ Max},$ $\overline{\text{RESET}} = 12.5 \text{ V}$	—	—	35	$\mu\text{A}$		
Flash $V_{CC}$ Active Current (Read) *1	$I_{CC1f}$	$\overline{\text{CE}}f = V_{IL},$ $\overline{\text{OE}} = V_{IH}$	$t_{\text{CYCLE}} = 5 \text{ MHz}$	Byte	—	—	13	mA
			$t_{\text{CYCLE}} = 5 \text{ MHz}$	Word	—	—	15	
			$t_{\text{CYCLE}} = 1 \text{ MHz}$	Byte	—	—	7	mA
			$t_{\text{CYCLE}} = 1 \text{ MHz}$	Word	—	—	7	
Flash $V_{CC}$ Active Current (Program/Erase) *2	$I_{CC2f}$	$\overline{\text{CE}}f = V_{IL}, \overline{\text{OE}} = V_{IH}$	—	—	35	mA		
Flash $V_{CC}$ Active Current (Read-While-Program) *5	$I_{CC3f}$	$\overline{\text{CE}}f = V_{IL}, \overline{\text{OE}} = V_{IH}$	Byte	—	—	48	mA	
			Word	—	—	50		
Flash $V_{CC}$ Active Current (Read-While-Erase) *5	$I_{CC4f}$	$\overline{\text{CE}}f = V_{IL}, \overline{\text{OE}} = V_{IH}$	Byte	—	—	48	mA	
			Word	—	—	50		
Flash $V_{CC}$ Active Current (Erase-Suspend-Program)	$I_{CC5f}$	$\overline{\text{CE}}f = V_{IL}, \overline{\text{OE}} = V_{IH}$	—	—	35	mA		
ACC Input Leakage Current	$I_{LIA}$	$V_{CCf} = V_{CCf} \text{ Max}, V_{CCS} = V_{CCS} \text{ Max},$ $\overline{\text{WP/ACC}} = V_{ACC} \text{ Max}$	—	—	20	mA		
SRAM $V_{CC}$ Active Current	$I_{CC1S}$	$V_{CCS} = V_{CCS} \text{ Max},$ $\overline{\text{CE}}1s = V_{IL},$ $\overline{\text{CE}}2s = V_{IH}$	$t_{\text{CYCLE}} = 10 \text{ MHz}$	—	—	40	mA	
SRAM $V_{CC}$ Active Current	$I_{CC2S}$	$\overline{\text{CE}}1s = 0.2 \text{ V},$ $\overline{\text{CE}}2s = V_{CCS} - 0.2 \text{ V}$	$t_{\text{CYCLE}} = 10 \text{ MHz}$	—	—	40	mA	
			$t_{\text{CYCLE}} = 1 \text{ MHz}$	—	—	8		
Flash $V_{CC}$ Standby Current	$I_{SB1f}$	$V_{CCf} = V_{CCf} \text{ Max}, \overline{\text{CE}}f = V_{CCf} \pm 0.3 \text{ V}$ $\overline{\text{RESET}} = V_{CCf} \pm 0.3 \text{ V},$ $\overline{\text{WP/ACC}} = V_{CCf} \pm 0.3 \text{ V}$	—	1	5	$\mu\text{A}$		
Flash $V_{CC}$ Standby Current (RESET)	$I_{SB2f}$	$V_{CCf} = V_{CCf} \text{ Max}, \overline{\text{RESET}} = V_{SS} \pm 0.3 \text{ V},$ $\overline{\text{WP/ACC}} = V_{CCf} \pm 0.3 \text{ V}$	—	1	5	$\mu\text{A}$		
Flash $V_{CC}$ Current (Automatic Sleep Mode) *3	$I_{SB3f}$	$V_{CCf} = V_{CCf} \text{ Max}, \overline{\text{CE}}f = V_{SS} \pm 0.3 \text{ V}$ $\overline{\text{RESET}} = V_{CCf} \pm 0.3 \text{ V},$ $\overline{\text{WP/ACC}} = V_{CCf} \pm 0.3 \text{ V}$ $V_{IN} = V_{CCf} \pm 0.3 \text{ V} \text{ or } V_{SS} \pm 0.3 \text{ V}$	—	1	5	$\mu\text{A}$		

(Continued)

# MB84VD2108XEM/2109XEM-70

(Continued)

Parameter	Symbol	Test Conditions	Value			Unit
			Min	Typ	Max	
SRAM V <sub>CC</sub> Standby Current	I <sub>SB1S</sub>	$\overline{CE1s} \geq V_{CCS} - 0.2 \text{ V}, CE2s \geq V_{CCS} - 0.2 \text{ V}$ $\overline{LB} = \overline{UB} \geq V_{CCS} - 0.2 \text{ V or } \leq 0.2 \text{ V}$	—	—	7	μA
SRAM V <sub>CC</sub> Standby Current	I <sub>SB2S</sub>	$\overline{CE1s} \geq V_{CCS} - 0.2 \text{ V or } \leq 0.2 \text{ V},$ $CE2s \leq 0.2 \text{ V}$ $\overline{LB} = \overline{UB} \geq V_{CCS} - 0.2 \text{ V or } \leq 0.2 \text{ V}$	—	—	7	μA
Input Low Level	V <sub>IL</sub>	—	-0.3	—	0.5	V
Input High Level	V <sub>IH</sub>	—	2.4	—	V <sub>CC</sub> +0.3 *6	V
Voltage for Sector Protection, and Temporary Sector Unprotection (RESET) *4	V <sub>ID</sub>	—	11.5	—	12.5	V
Voltage for Program Acceleration ( $\overline{WP/ACC}$ ) *4	V <sub>ACC</sub>	—	8.5	9.0	9.5	V
SRAM Output Low Level	V <sub>OL</sub>	V <sub>CCS</sub> = V <sub>CCS</sub> Min, I <sub>OL</sub> = 4.0 mA	—	—	0.45	V
SRAM Output High Level	V <sub>OH</sub>	V <sub>CCS</sub> = V <sub>CCS</sub> Min, I <sub>OH</sub> = -0.5 mA	2.4	—	—	V
Flash Output Low Level	V <sub>OL</sub>	V <sub>CCF</sub> = V <sub>CCF</sub> Min, I <sub>OL</sub> = 4.0 mA	—	—	0.4	V
Flash Output High Level	V <sub>OH</sub>	V <sub>CCF</sub> = V <sub>CCF</sub> Min, I <sub>OH</sub> = -0.5 mA	2.4	—	—	V
Flash Low V <sub>CCF</sub> Lock-Out Voltage	V <sub>LKO</sub>	—	2.3	—	2.5	V

\* 1 : The I<sub>CC</sub> current listed includes both the DC operating current and the frequency dependent component.

\*2 : I<sub>CC</sub> active while Embedded Algorithm (program or erase) is in progress.

\*3 : Automatic sleep mode enables the low power mode when address remain stable for 150 ns.

\*4 : Applicable for only V<sub>CCF</sub> applying.

\*5 : Embedded Algorithm (program or erase) is in progress. (@5 MHz)

\*6 : V<sub>CC</sub> indicates lower of V<sub>CCF</sub> or V<sub>CCS</sub>.

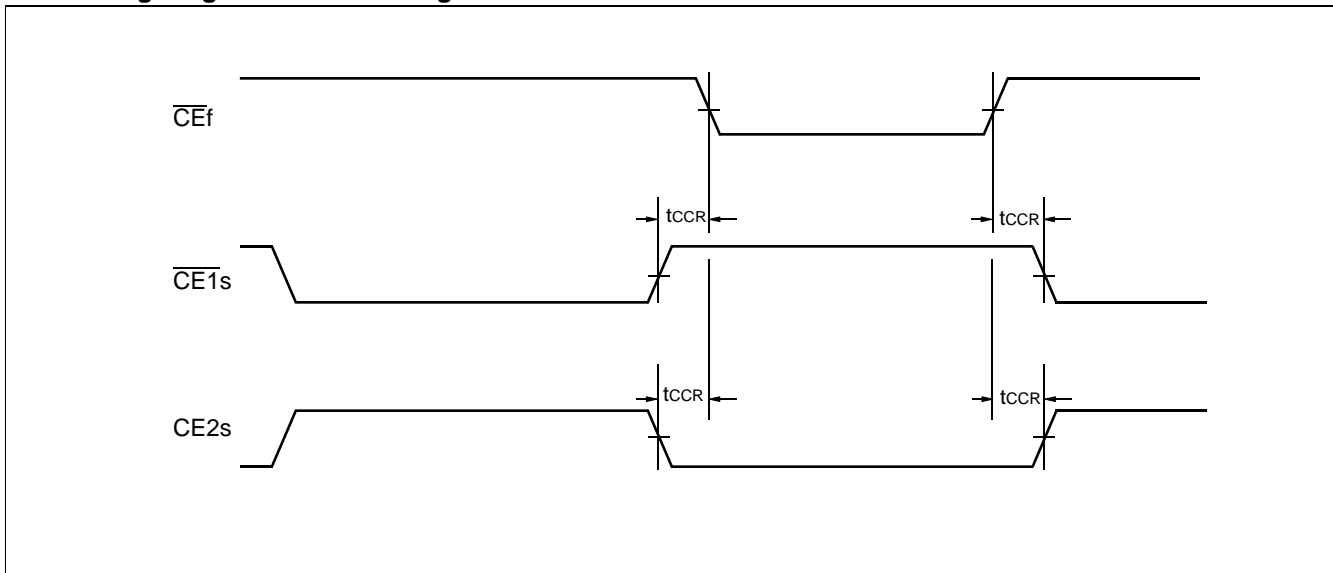
# MB84VD2108XEM/2109XEM-70

## 2. AC Characteristics

- $\overline{CE}$  Timing

Parameter	Symbol		Test Setup	Value	Unit
	JEDEC	Standard		Min	
$\overline{CE}$ Recover Time	—	$t_{CCR}$	—	0	ns

- Timing Diagram for alternating SRAM to Flash



- **Flash Characteristics**

Please refer to “■16M FLASH MEMORY CHARACTERISTICS for MCP” part.

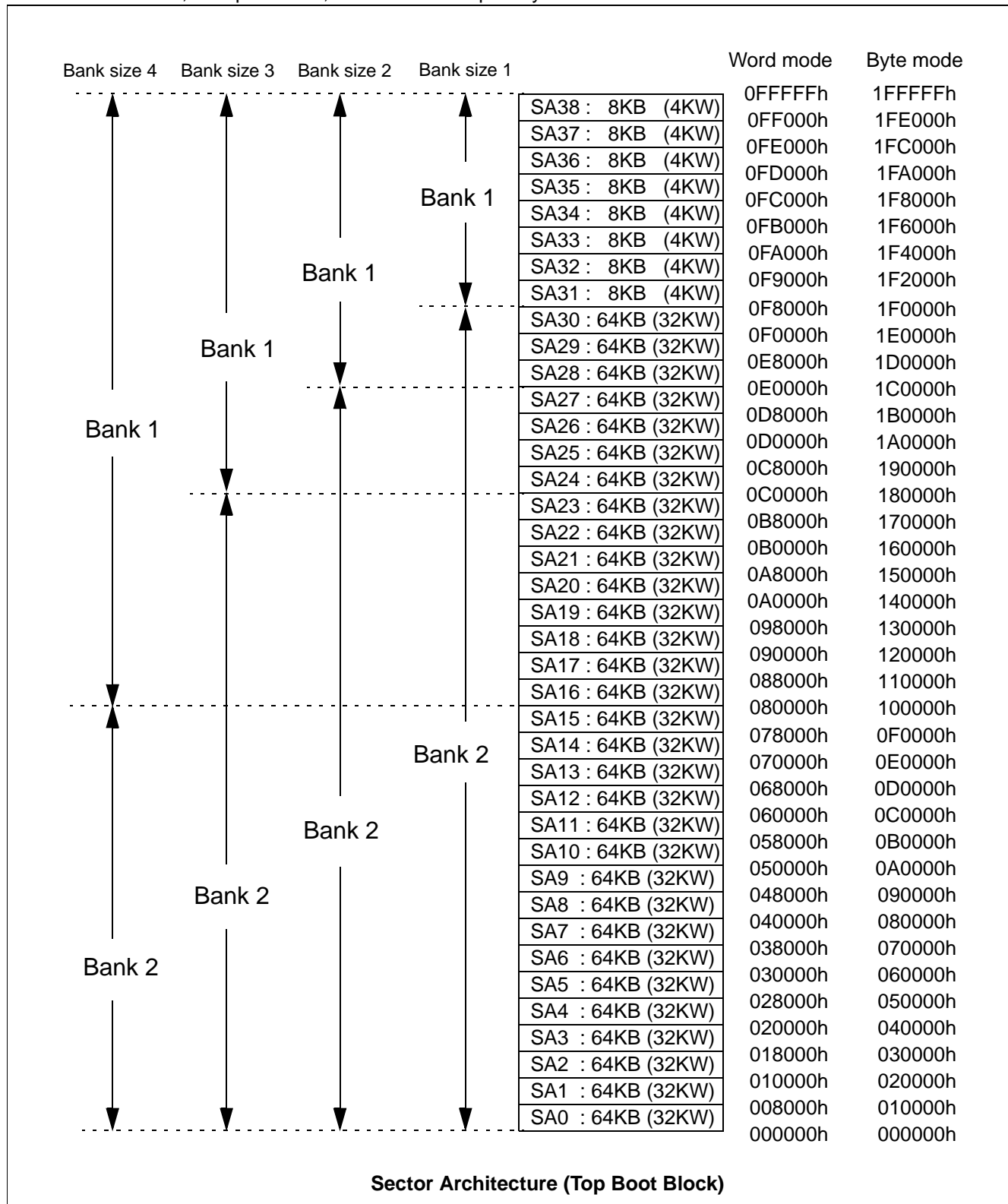
- **SRAM Characteristics,**

Please refer to “■2M SRAM CHARACTERISTICS for MCP” part.

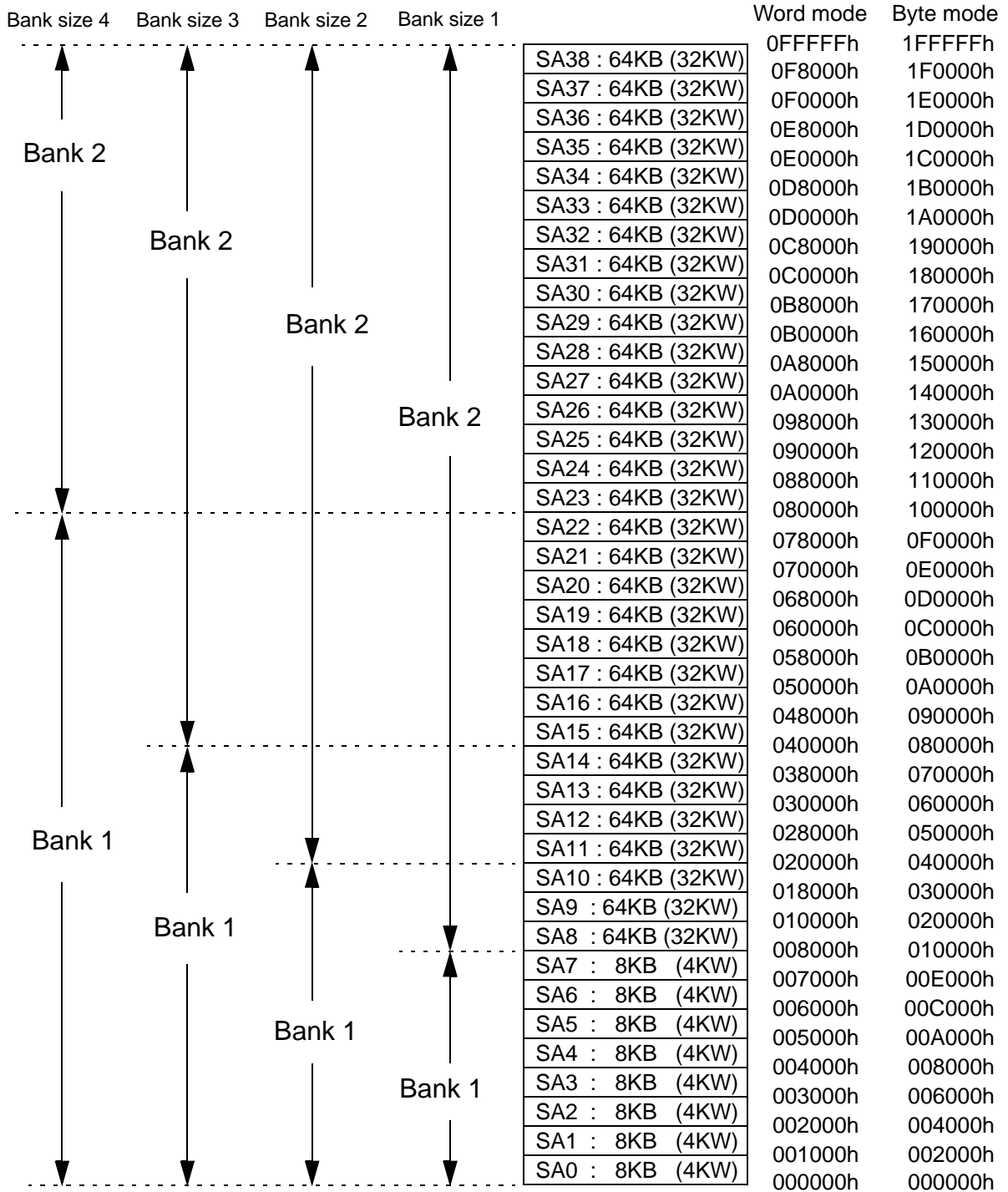
## ■ 16M FLASH MEMORY CHARACTERISTICS for MCP

### 1. Flexible Sector-erase Architecture on Flash Memory

- Eight 4 K words, and thirty one 32 K words.
- Individual-sector, multiple-sector, or bulk-erase capability.



(Continued)



**Sector Architecture (Bottom Boot Block)**

# MB84VD2108XEM/2109XEM-70

**Sector Address Table (Top Boot Block, Bank Size=1)**

Bank	Sector	Sector Address								Address Range (Byte mode)	Address Range (Word mode)
		Bank Address									
		A19	A18	A17	A16	A15	A14	A13	A12		
<b>Bank 2</b>	SA0	0	0	0	0	0	X	X	X	000000h to 00FFFFh	000000h to 007FFFh
	SA1	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA2	0	0	0	1	0	X	X	X	020000h to 02FFFFh	010000h to 017FFFh
	SA3	0	0	0	1	1	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh
	SA4	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh
	SA5	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh
	SA6	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh
	SA7	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh
	SA8	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh
	SA9	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh
	SA10	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh
	SA11	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA12	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh
	SA13	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA14	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh
	SA15	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFh	078000h to 07FFFFh
	SA16	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh
	SA17	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh
	SA18	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh
	SA19	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh
	SA20	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh
	SA21	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh
	SA22	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh
	SA23	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh
	SA24	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh
	SA25	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh
	SA26	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh
	SA27	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh
	SA28	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh
	SA29	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh
SA30	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh	
<b>Bank 1</b>	SA31	1	1	1	1	1	0	0	0	1F0000h to 1F1FFFh	0F8000h to 0F8FFFh
	SA32	1	1	1	1	1	0	0	1	1F2000h to 1F3FFFh	0F9000h to 0F9FFFh
	SA33	1	1	1	1	1	0	1	0	1F4000h to 1F5FFFh	0FA000h to 0FAFFFh
	SA34	1	1	1	1	1	0	1	1	1F6000h to 1F7FFFh	0FB000h to 0FBFFFh
	SA35	1	1	1	1	1	1	0	0	1F8000h to 1F9FFFh	0FC000h to 0FCFFFh
	SA36	1	1	1	1	1	1	0	1	1FA000h to 1FBFFFh	0FD000h to 0FDFFFh
	SA37	1	1	1	1	1	1	1	0	1FC000h to 1FDFFFh	0FE000h to 0FEFFFh
	SA38	1	1	1	1	1	1	1	1	1FE000h to 1FFFFFh	0FF000h to 0FFFFFh

# MB84VD2108XEM/2109XEM-70

Sector Address Table (Bottom Boot Block, Bank Size=1)

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)	
		Bank Address										
		A19	A18	A17	A16	A15	A14	A13	A12			
Bank 1	SA0	0	0	0	0	0	0	0	0	000000h to 001FFFh	000000h to 000FFFh	
	SA1	0	0	0	0	0	0	0	1	002000h to 003FFFh	001000h to 001FFFh	
	SA2	0	0	0	0	0	0	0	1	0	004000h to 005FFFh	002000h to 002FFFh
	SA3	0	0	0	0	0	0	0	1	1	006000h to 007FFFh	003000h to 003FFFh
	SA4	0	0	0	0	0	0	1	0	0	008000h to 009FFFh	004000h to 004FFFh
	SA5	0	0	0	0	0	0	1	0	1	00A000h to 00BFFFh	005000h to 005FFFh
	SA6	0	0	0	0	0	0	1	1	0	00C000h to 00DFFFh	006000h to 006FFFh
	SA7	0	0	0	0	0	0	1	1	1	00E000h to 00FFFFh	007000h to 007FFFh
Bank 2	SA8	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh	
	SA9	0	0	0	1	0	X	X	X	020000h to 02FFFFh	010000h to 017FFFh	
	SA10	0	0	0	1	1	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh	
	SA11	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh	
	SA12	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh	
	SA13	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh	
	SA14	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh	
	SA15	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh	
	SA16	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh	
	SA17	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh	
	SA18	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh	
	SA19	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh	
	SA20	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh	
	SA21	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh	
	SA22	0	1	1	1	1	X	X	X	0F0000h to 0FFFFh	078000h to 07FFFFh	
	SA23	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh	
	SA24	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh	
	SA25	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh	
	SA26	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh	
	SA27	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh	
	SA28	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh	
	SA29	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh	
	SA30	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh	
	SA31	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh	
	SA32	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh	
	SA33	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh	
	SA34	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh	
	SA35	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh	
	SA36	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh	
	SA37	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh	
	SA38	1	1	1	1	1	X	X	X	1F0000h to 1FFFFh	0F8000h to 0FFFFh	



# MB84VD2108XEM/2109XEM-70

**Sector Address Table (Top Boot Block, Bank Size=2)**

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)
		Bank Address									
		A19	A18	A17	A16	A15	A14	A13	A12		
Bank 2	SA0	0	0	0	0	0	X	X	X	000000h to 00FFFFh	000000h to 007FFFh
	SA1	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA2	0	0	0	1	0	X	X	X	020000h to 02FFFFh	010000h to 017FFFh
	SA3	0	0	0	1	1	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh
	SA4	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh
	SA5	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh
	SA6	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh
	SA7	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh
	SA8	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh
	SA9	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh
	SA10	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh
	SA11	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA12	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh
	SA13	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA14	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh
	SA15	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFFh	078000h to 077FFFh
	SA16	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh
	SA17	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh
	SA18	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh
	SA19	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh
	SA20	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh
	SA21	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh
	SA22	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh
	SA23	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh
	SA24	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh
	SA25	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh
	SA26	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh
SA27	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh	
Bank 1	SA28	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh
	SA29	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh
	SA30	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh
	SA31	1	1	1	1	1	0	0	0	1F0000h to 1F1FFFh	0F8000h to 0F8FFFh
	SA32	1	1	1	1	1	0	0	1	1F2000h to 1F3FFFh	0F9000h to 0F9FFFh
	SA33	1	1	1	1	1	0	1	0	1F4000h to 1F5FFFh	0FA000h to 0FAFFFh
	SA34	1	1	1	1	1	0	1	1	1F6000h to 1F7FFFh	0FB000h to 0FBFFFh
	SA35	1	1	1	1	1	1	0	0	1F8000h to 1F9FFFh	0FC000h to 0FCFFFh
	SA36	1	1	1	1	1	1	0	1	1FA000h to 1FBFFFh	0FD000h to 0FDFFFh
	SA37	1	1	1	1	1	1	1	0	1FC000h to 1FDFFFh	0FE000h to 0FEFFFh
	SA38	1	1	1	1	1	1	1	1	1FE000h to 1FFFFFFh	0FF000h to 0FFFFFFh

# MB84VD2108XEM/2109XEM-70

Sector Address Table (Bottom Boot Block, Bank Size=2)

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)	
		Bank Address										
		A19	A18	A17	A16	A15	A14	A13	A12			
Bank 1	SA0	0	0	0	0	0	0	0	0	000000h to 001FFFh	000000h to 000FFFh	
	SA1	0	0	0	0	0	0	0	1	002000h to 003FFFh	001000h to 001FFFh	
	SA2	0	0	0	0	0	0	0	1	0	004000h to 005FFFh	002000h to 002FFFh
	SA3	0	0	0	0	0	0	0	1	1	006000h to 007FFFh	003000h to 003FFFh
	SA4	0	0	0	0	0	0	1	0	0	008000h to 009FFFh	004000h to 004FFFh
	SA5	0	0	0	0	0	0	1	0	1	00A000h to 00BFFFh	005000h to 005FFFh
	SA6	0	0	0	0	0	0	1	1	0	00C000h to 00DFFFh	006000h to 006FFFh
	SA7	0	0	0	0	0	0	1	1	1	00E000h to 00FFFFh	007000h to 007FFFh
	SA8	0	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA9	0	0	0	1	0	X	X	X	X	020000h to 02FFFFh	010000h to 017FFFh
SA10	0	0	0	1	1	X	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh	
Bank 2	SA11	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh	
	SA12	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh	
	SA13	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh	
	SA14	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh	
	SA15	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh	
	SA16	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh	
	SA17	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh	
	SA18	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh	
	SA19	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh	
	SA20	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh	
	SA21	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh	
	SA22	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFFh	078000h to 07FFFFh	
	SA23	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh	
	SA24	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh	
	SA25	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh	
	SA26	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh	
	SA27	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh	
	SA28	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh	
	SA29	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh	
	SA30	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh	
	SA31	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh	
	SA32	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh	
	SA33	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh	
	SA34	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh	
	SA35	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh	
	SA36	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh	
	SA37	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh	
	SA38	1	1	1	1	1	X	X	X	1F0000h to 1FFFFFFh	0F8000h to 0FFFFFFh	

# MB84VD2108XEM/2109XEM-70

**Sector Address Table (Top Boot Block, Bank Size=3)**

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)
		Bank Address									
		A <sub>19</sub>	A <sub>18</sub>	A <sub>17</sub>	A <sub>16</sub>	A <sub>15</sub>	A <sub>14</sub>	A <sub>13</sub>	A <sub>12</sub>		
Bank 2	SA0	0	0	0	0	0	X	X	X	000000h to 00FFFFh	000000h to 007FFFh
	SA1	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA2	0	0	0	1	0	X	X	X	020000h to 02FFFFh	010000h to 017FFFh
	SA3	0	0	0	1	1	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh
	SA4	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh
	SA5	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh
	SA6	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh
	SA7	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh
	SA8	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh
	SA9	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh
	SA10	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh
	SA11	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA12	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh
	SA13	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA14	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh
	SA15	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFh	078000h to 07FFFFh
	SA16	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh
	SA17	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh
	SA18	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh
	SA19	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh
	SA20	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh
	SA21	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh
	SA22	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh
SA23	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh	
Bank 1	SA24	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh
	SA25	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh
	SA26	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh
	SA27	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh
	SA28	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh
	SA29	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh
	SA30	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh
	SA31	1	1	1	1	1	0	0	0	1F0000h to 1F1FFFh	0F8000h to 0F8FFFh
	SA32	1	1	1	1	1	0	0	1	1F2000h to 1F3FFFh	0F9000h to 0F9FFFh
	SA33	1	1	1	1	1	0	1	0	1F4000h to 1F5FFFh	0FA000h to 0FAFFFh
	SA34	1	1	1	1	1	0	1	1	1F6000h to 1F7FFFh	0FB000h to 0FBFFFh
	SA35	1	1	1	1	1	1	0	0	1F8000h to 1F9FFFh	0FC000h to 0FCFFFh
	SA36	1	1	1	1	1	1	0	1	1FA000h to 1FBFFFh	0FD000h to 0FDFFFh
	SA37	1	1	1	1	1	1	1	0	1FC000h to 1FDFFFh	0FE000h to 0FEFFFh
	SA38	1	1	1	1	1	1	1	1	1FE000h to 1FFFFFh	0FF000h to 0FFFFFh

# MB84VD2108XEM/2109XEM-70

Sector Address Table (Bottom Boot Block, Bank Size=3)

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)
		Bank Address									
		A19	A18	A17	A16	A15	A14	A13	A12		
Bank 1	SA0	0	0	0	0	0	0	0	0	000000h to 001FFFh	000000h to 000FFFh
	SA1	0	0	0	0	0	0	0	1	002000h to 003FFFh	001000h to 001FFFh
	SA2	0	0	0	0	0	0	0	1	004000h to 005FFFh	002000h to 002FFFh
	SA3	0	0	0	0	0	0	0	1	006000h to 007FFFh	003000h to 003FFFh
	SA4	0	0	0	0	0	0	1	0	008000h to 009FFFh	004000h to 004FFFh
	SA5	0	0	0	0	0	0	1	0	00A000h to 00BFFFh	005000h to 005FFFh
	SA6	0	0	0	0	0	0	1	1	00C000h to 00DFFFh	006000h to 006FFFh
	SA7	0	0	0	0	0	0	1	1	00E000h to 00FFFFh	007000h to 007FFFh
	SA8	0	0	0	0	0	1	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA9	0	0	0	1	0	0	X	X	020000h to 02FFFFh	010000h to 017FFFh
	SA10	0	0	0	1	1	0	X	X	030000h to 03FFFFh	018000h to 01FFFFh
	SA11	0	0	1	0	0	0	X	X	040000h to 04FFFFh	020000h to 027FFFh
	SA12	0	0	1	0	1	0	X	X	050000h to 05FFFFh	028000h to 02FFFFh
	SA13	0	0	1	1	0	0	X	X	060000h to 06FFFFh	030000h to 037FFFh
SA14	0	0	1	1	1	0	X	X	070000h to 07FFFFh	038000h to 03FFFFh	
Bank 2	SA15	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh
	SA16	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh
	SA17	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh
	SA18	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA19	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh
	SA20	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA21	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh
	SA22	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFh	078000h to 07FFFFh
	SA23	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh
	SA24	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh
	SA25	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh
	SA26	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh
	SA27	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh
	SA28	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh
	SA29	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh
	SA30	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh
	SA31	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh
	SA32	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh
	SA33	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh
	SA34	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh
	SA35	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh
	SA36	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh
	SA37	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh
	SA38	1	1	1	1	1	X	X	X	1F0000h to 1FFFFFh	0F8000h to 0FFFFFh

# MB84VD2108XEM/2109XEM-70

**Sector Address Table (Top Boot Block, Bank Size=4)**

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)
		Bank Address									
		A19	A18	A17	A16	A15	A14	A13	A12		
<b>Bank 2</b>	SA0	0	0	0	0	0	X	X	X	000000h to 00FFFFh	000000h to 007FFFh
	SA1	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA2	0	0	0	1	0	X	X	X	020000h to 02FFFFh	010000h to 017FFFh
	SA3	0	0	0	1	1	X	X	X	030000h to 03FFFFh	018000h to 01FFFFh
	SA4	0	0	1	0	0	X	X	X	040000h to 04FFFFh	020000h to 027FFFh
	SA5	0	0	1	0	1	X	X	X	050000h to 05FFFFh	028000h to 02FFFFh
	SA6	0	0	1	1	0	X	X	X	060000h to 06FFFFh	030000h to 037FFFh
	SA7	0	0	1	1	1	X	X	X	070000h to 07FFFFh	038000h to 03FFFFh
	SA8	0	1	0	0	0	X	X	X	080000h to 08FFFFh	040000h to 047FFFh
	SA9	0	1	0	0	1	X	X	X	090000h to 09FFFFh	048000h to 04FFFFh
	SA10	0	1	0	1	0	X	X	X	0A0000h to 0AFFFFh	050000h to 057FFFh
	SA11	0	1	0	1	1	X	X	X	0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA12	0	1	1	0	0	X	X	X	0C0000h to 0CFFFFh	060000h to 067FFFh
	SA13	0	1	1	0	1	X	X	X	0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA14	0	1	1	1	0	X	X	X	0E0000h to 0EFFFFh	070000h to 077FFFh
SA15	0	1	1	1	1	X	X	X	0F0000h to 0FFFFFh	078000h to 07FFFFh	
<b>Bank 1</b>	SA16	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh
	SA17	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh
	SA18	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh
	SA19	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh
	SA20	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh
	SA21	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh
	SA22	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh
	SA23	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh
	SA24	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh
	SA25	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh
	SA26	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh
	SA27	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh
	SA28	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh
	SA29	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh
	SA30	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh
	SA31	1	1	1	1	1	0	0	0	1F0000h to 1F1FFFh	0F8000h to 0F8FFFh
	SA32	1	1	1	1	1	0	0	1	1F2000h to 1F3FFFh	0F9000h to 0F9FFFh
	SA33	1	1	1	1	1	0	1	0	1F4000h to 1F5FFFh	0FA000h to 0FAFFFh
	SA34	1	1	1	1	1	0	1	1	1F6000h to 1F7FFFh	0FB000h to 0FBFFFh
	SA35	1	1	1	1	1	1	0	0	1F8000h to 1F9FFFh	0FC000h to 0FCFFFh
	SA36	1	1	1	1	1	1	0	1	1FA000h to 1FBFFFh	0FD000h to 0FDFFFh
	SA37	1	1	1	1	1	1	1	0	1FC000h to 1FDFFFh	0FE000h to 0FEFFFh
	SA38	1	1	1	1	1	1	1	1	1FE000h to 1FFFFFh	0FF000h to 0FFFFFh

# MB84VD2108XEM/2109XEM-70

Sector Address Table (Bottom Boot Block, Bank Size=4)

Bank	Sector	Sector Address								Address Range (BYTE mode)	Address Range (WORD mode)	
		Bank Address										
		A19	A18	A17	A16	A15	A14	A13	A12			
Bank 1	SA0	0	0	0	0	0	0	0	0	000000h to 001FFFh	000000h to 000FFFh	
	SA1	0	0	0	0	0	0	0	1	002000h to 003FFFh	001000h to 001FFFh	
	SA2	0	0	0	0	0	0	0	1	0	004000h to 005FFFh	002000h to 002FFFh
	SA3	0	0	0	0	0	0	0	1	1	006000h to 007FFFh	003000h to 003FFFh
	SA4	0	0	0	0	0	0	1	0	0	008000h to 009FFFh	004000h to 004FFFh
	SA5	0	0	0	0	0	0	1	0	1	00A000h to 00BFFFh	005000h to 005FFFh
	SA6	0	0	0	0	0	0	1	1	0	00C000h to 00DFFFh	006000h to 006FFFh
	SA7	0	0	0	0	0	0	1	1	1	00E000h to 00FFFFh	007000h to 007FFFh
	SA8	0	0	0	0	0	1	X	X	X	010000h to 01FFFFh	008000h to 00FFFFh
	SA9	0	0	0	1	0	X	X	X		020000h to 02FFFFh	010000h to 017FFFh
	SA10	0	0	0	1	1	X	X	X		030000h to 03FFFFh	018000h to 01FFFFh
	SA11	0	0	1	0	0	X	X	X		040000h to 04FFFFh	020000h to 027FFFh
	SA12	0	0	1	0	1	X	X	X		050000h to 05FFFFh	028000h to 02FFFFh
	SA13	0	0	1	1	0	X	X	X		060000h to 06FFFFh	030000h to 037FFFh
	SA14	0	0	1	1	1	X	X	X		070000h to 07FFFFh	038000h to 03FFFFh
	SA15	0	1	0	0	0	X	X	X		080000h to 08FFFFh	040000h to 047FFFh
	SA16	0	1	0	0	1	X	X	X		090000h to 09FFFFh	048000h to 04FFFFh
	SA17	0	1	0	1	0	X	X	X		0A0000h to 0AFFFFh	050000h to 057FFFh
	SA18	0	1	0	1	1	X	X	X		0B0000h to 0BFFFFh	058000h to 05FFFFh
	SA19	0	1	1	0	0	X	X	X		0C0000h to 0CFFFFh	060000h to 067FFFh
	SA20	0	1	1	0	1	X	X	X		0D0000h to 0DFFFFh	068000h to 06FFFFh
	SA21	0	1	1	1	0	X	X	X		0E0000h to 0EFFFFh	070000h to 077FFFh
SA22	0	1	1	1	1	X	X	X		0F0000h to 0FFFFFh	078000h to 07FFFFh	
Bank 2	SA23	1	0	0	0	0	X	X	X	100000h to 10FFFFh	080000h to 087FFFh	
	SA24	1	0	0	0	1	X	X	X	110000h to 11FFFFh	088000h to 08FFFFh	
	SA25	1	0	0	1	0	X	X	X	120000h to 12FFFFh	090000h to 097FFFh	
	SA26	1	0	0	1	1	X	X	X	130000h to 13FFFFh	098000h to 09FFFFh	
	SA27	1	0	1	0	0	X	X	X	140000h to 14FFFFh	0A0000h to 0A7FFFh	
	SA28	1	0	1	0	1	X	X	X	150000h to 15FFFFh	0A8000h to 0AFFFFh	
	SA29	1	0	1	1	0	X	X	X	160000h to 16FFFFh	0B0000h to 0B7FFFh	
	SA30	1	0	1	1	1	X	X	X	170000h to 17FFFFh	0B8000h to 0BFFFFh	
	SA31	1	1	0	0	0	X	X	X	180000h to 18FFFFh	0C0000h to 0C7FFFh	
	SA32	1	1	0	0	1	X	X	X	190000h to 19FFFFh	0C8000h to 0CFFFFh	
	SA33	1	1	0	1	0	X	X	X	1A0000h to 1AFFFFh	0D0000h to 0D7FFFh	
	SA34	1	1	0	1	1	X	X	X	1B0000h to 1BFFFFh	0D8000h to 0DFFFFh	
	SA35	1	1	1	0	0	X	X	X	1C0000h to 1CFFFFh	0E0000h to 0E7FFFh	
	SA36	1	1	1	0	1	X	X	X	1D0000h to 1DFFFFh	0E8000h to 0EFFFFh	
	SA37	1	1	1	1	0	X	X	X	1E0000h to 1EFFFFh	0F0000h to 0F7FFFh	
	SA38	1	1	1	1	1	X	X	X	1F0000h to 1FFFFFh	0F8000h to 0FFFFFh	

# MB84VD2108XEM/2109XEM-70

**Sector Group Addresses Table (Top Boot Block)**

Sector Group	A <sub>19</sub>	A <sub>18</sub>	A <sub>17</sub>	A <sub>16</sub>	A <sub>15</sub>	A <sub>14</sub>	A <sub>13</sub>	A <sub>12</sub>	Sectors
SGA0	0	0	0	0	0	X	X	X	SA0
SGA1	0	0	0	0	1	X	X	X	SA1 to SA3
	0	0	0	1	0	X	X	X	
	0	0	0	1	1	X	X	X	
SGA2	0	0	1	X	X	X	X	X	SA4 to SA7
SGA3	0	1	0	X	X	X	X	X	SA8 to SA11
SGA4	0	1	1	X	X	X	X	X	SA12 to SA15
SGA5	1	0	0	X	X	X	X	X	SA16 to SA19
SGA6	1	0	1	X	X	X	X	X	SA20 to SA23
SGA7	1	1	0	X	X	X	X	X	SA24 to SA27
SGA8	1	1	1	0	0	X	X	X	SA28 to SA30
	1	1	1	0	1	X	X	X	
	1	1	1	1	0	X	X	X	
SGA9	1	1	1	1	1	0	0	0	SA31
SGA10	1	1	1	1	1	0	0	1	SA32
SGA11	1	1	1	1	1	0	1	0	SA33
SGA12	1	1	1	1	1	0	1	1	SA34
SGA13	1	1	1	1	1	1	0	0	SA35
SGA14	1	1	1	1	1	1	0	1	SA36
SGA15	1	1	1	1	1	1	1	0	SA37
SGA16	1	1	1	1	1	1	1	1	SA38

**Sector Group Addresses Table (Bottom Boot Block)**

Sector Group	A <sub>19</sub>	A <sub>18</sub>	A <sub>17</sub>	A <sub>16</sub>	A <sub>15</sub>	A <sub>14</sub>	A <sub>13</sub>	A <sub>12</sub>	Sectors
SGA0	0	0	0	0	0	0	0	0	SA0
SGA1	0	0	0	0	0	0	0	1	SA1
SGA2	0	0	0	0	0	0	1	0	SA2
SGA3	0	0	0	0	0	0	1	1	SA3
SGA4	0	0	0	0	0	1	0	0	SA4
SGA5	0	0	0	0	0	1	0	1	SA5
SGA6	0	0	0	0	0	1	1	0	SA6
SGA7	0	0	0	0	0	1	1	1	SA7
SGA8	0	0	0	0	1	X	X	X	SA8 to SA10
	0	0	0	1	0	X	X	X	
	0	0	0	1	1	X	X	X	
SGA9	0	0	1	X	X	X	X	X	SA11 to SA14
SGA10	0	1	0	X	X	X	X	X	SA15 to SA18
SGA11	0	1	1	X	X	X	X	X	SA19 to SA22
SGA12	1	0	0	X	X	X	X	X	SA23 to SA26
SGA13	1	0	1	X	X	X	X	X	SA27 to SA30
SGA14	1	1	0	X	X	X	X	X	SA31 to SA34
SGA15	1	1	1	0	0	X	X	X	SA35 to SA37
	1	1	1	0	1	X	X	X	
	1	1	1	1	0	X	X	X	
SGA16	1	1	1	1	1	X	X	X	SA38

# MB84VD2108XEM/2109XEM-70

Flash Memory Autoselect Codes Table

Type		A <sub>19</sub> to A <sub>12</sub>	A <sub>6</sub>	A <sub>1</sub>	A <sub>0</sub>	A <sub>-1</sub> *1	Code (HEX)	
Manufacturer's Code		X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IL</sub>	04h	
Device Code	Top Boot Block Bank Size=1	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	36h
		Word					X	2236h
	Bottom Boot Block Bank Size=1	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	39
		Word					X	2239h
	Top Boot Block Bank Size=2	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	2D
		Word					X	222Dh
	Bottom Boot Block Bank Size=2	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	2E
		Word					X	222Eh
	Top Boot Block Bank Size=3	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	28h
		Word					X	2228h
	Bottom Boot Block Bank Size=3	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	2Bh
		Word					X	222Bh
	Top Boot Block Bank Size=4	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	33h
		Word					X	2233h
	Bottom Boot Block Bank Size=4	Byte	X	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	35
		Word					X	2235h
Sector Group protect		Sector Group Address	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IL</sub>	01h*2	

\*1: A<sub>-1</sub> is for Byte mode.

\*2: Output 01h at protected sector address and output 00h at unprotected sector address.



# MB84VD2108XEM/2109XEM-70

### Flash Memory Command Definitions Table

Command Sequence		Bus Write Cycles Req'd	First Bus Write Cycle		Second Bus Write Cycle		Third Bus Write Cycle		Fourth Bus Read/Write Cycle		Fifth Bus Write Cycle		Sixth Bus Write Cycle	
			Addr.	Data	Addr.	Data	Addr.	Data	Addr.	Data	Addr.	Data	Addr.	Data
Read/Reset *1		1	XXXh	F0h	—	—	—	—	—	—	—	—	—	—
Read/Reset *1	Word	3	555h	AAh	2AAh	55h	555h	F0h	RA	RD	—	—	—	—
	Byte		AAAh		555h		AAAh							
Autoselect	Word	3	555h	AAh	2AAh	55h	(BA) 555h	90h	—	—	—	—	—	—
	Byte		AAAh		555h		(BA) AAAh							
Program	Word	4	555h	AAh	2AAh	55h	555h	A0h	PA	PD	—	—	—	—
	Byte		AAAh		555h		AAAh							
Chip Erase	Word	6	555h	AAh	2AAh	55h	555h	80h	555h	AAh	2AAh	55h	555h	10h
	Byte		AAAh		555h		AAAh		555h		AAAh			
Sector Erase	Word	6	555h	AAh	2AAh	55h	555h	80h	555h	AAh	2AAh	55h	SA	30h
	Byte		AAAh		555h		AAAh		555h		AAAh			
Sector Erase Suspend		1	BA	B0h	—	—	—	—	—	—	—	—	—	—
Sector Erase Resume		1	BA	30h	—	—	—	—	—	—	—	—	—	—
Set to Fast Mode	Word	3	555h	AAh	2AAh	55h	555h	20h	—	—	—	—	—	—
	Byte		AAAh		555h		AAAh							
Fast Program*2	Word	2	XXXh	A0h	PA	PD	—	—	—	—	—	—	—	—
	Byte		—	—	—	—	—	—	—	—	—	—	—	—
Reset from Fast Mode *2	Word	2	BA	90h	XXXh	F0h *6	—	—	—	—	—	—	—	—
	Byte		—	—	—	—	—	—	—	—	—	—	—	—
Extended Sector Group Protection *3	Word	4	XXXh	60h	SPA	60h	SPA	40h	SPA	SD	—	—	—	—
	Byte		—	—	—	—	—	—	—	—	—	—	—	—
Query *4	Word	1	55h	98h	—	—	—	—	—	—	—	—	—	—
	Byte		AAh	—	—	—	—	—	—	—	—	—	—	—
HiddenROM Entry	Word	3	555h	AAh	2AAh	55h	555h	88h	—	—	—	—	—	—
	Byte		AAAh		555h		AAAh							
HiddenROM Program *5	Word	4	555h	AAh	2AAh	55h	555h	A0h	PA	PD	—	—	—	—
	Byte		AAAh		555h		AAAh							
HiddenROM Erase *5	Word	6	555h	AAh	2AAh	55h	555h	80h	555h	AAh	2AAh	55h	HRA	30h
	Byte		AAAh		555h		AAAh		555h		AAAh			
HiddenROM Exit *5	Word	4	555h	AAh	2AAh	55h	(HRBA) 555h	90h	XXXh	00h	—	—	—	—
	Byte		AAAh		555h		(HRBA) AAAh							



# MB84VD2108XEM/2109XEM-70

## • Read Only Operations Characteristics (Flash)

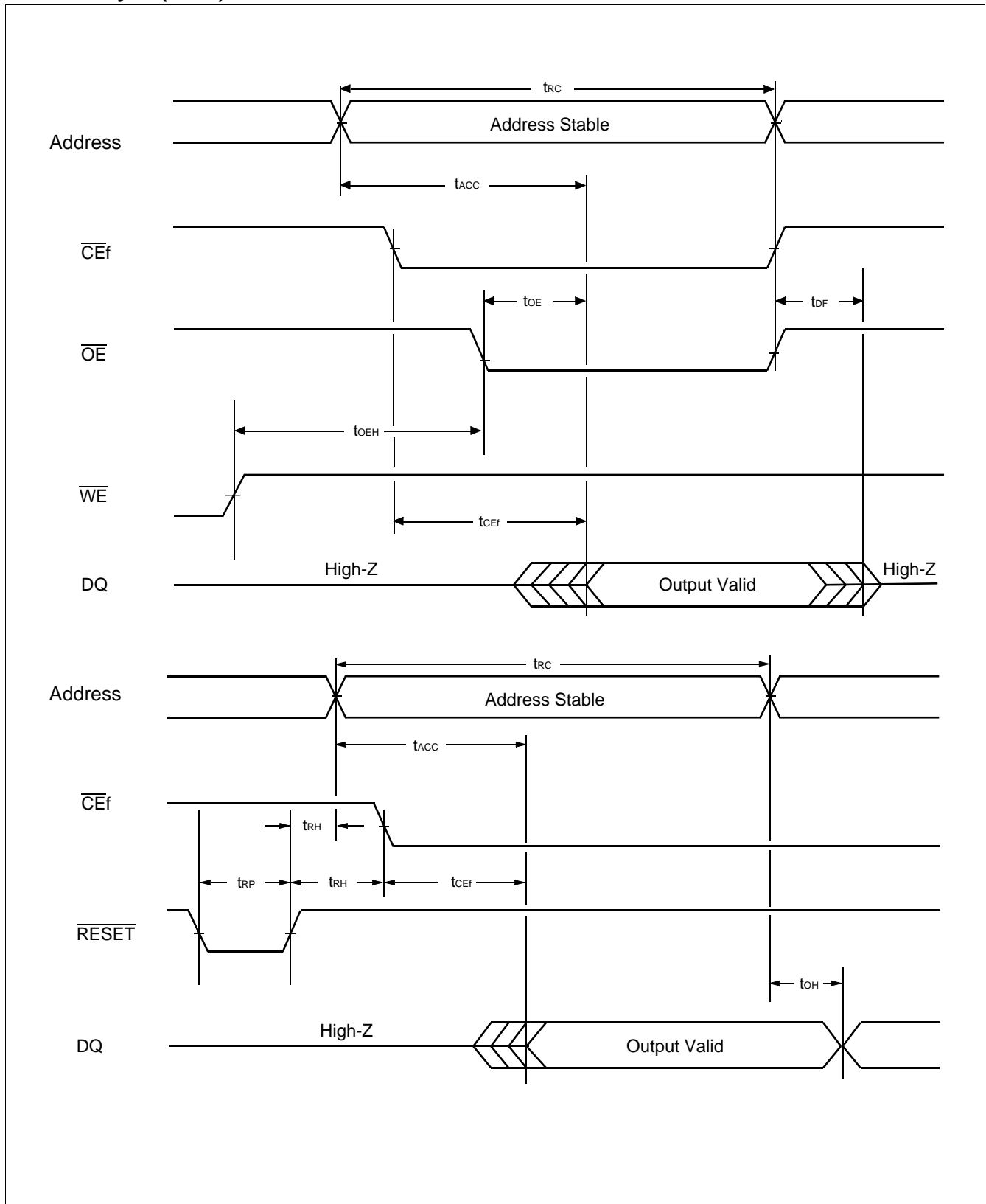
Parameter	Symbol		Test Setup	Value*		Unit
	JEDEC	Standard		Min	Max	
Read Cycle Time	t <sub>AVAV</sub>	t <sub>RC</sub>	—	70	—	ns
Address to Output Delay	t <sub>AVQV</sub>	t <sub>ACC</sub>	$\overline{CE}f = V_{IL}$ $\overline{OE} = V_{IL}$	—	70	ns
Chip Enable to Output Delay	t <sub>ELQV</sub>	t <sub>CEf</sub>	$\overline{OE} = V_{IL}$	—	70	ns
Output Enable to Output Delay	t <sub>GLQV</sub>	t <sub>OE</sub>	—	—	30	ns
Chip Enable to Output High-Z	t <sub>EHQZ</sub>	t <sub>DF</sub>	—	—	25	ns
Output Enable to Output High-Z	t <sub>GHQZ</sub>	t <sub>DF</sub>	—	—	25	ns
Output Hold Time From Addresses, $\overline{CE}f$ or $\overline{OE}$ , Whichever Occurs First	t <sub>AXQX</sub>	t <sub>OH</sub>	—	0	—	ns
$\overline{RESET}$ Pin Low to Read Mode	—	t <sub>READY</sub>	—	—	20	μs

### \* : Test Conditions

Output Load : 1 TTL gate and 30 pF  
 Input rise and fall times: 5 ns  
 Input pulse levels : 0.0 V to 3.0 V  
 Timing measurement reference level  
     Input : 1.5 V  
     Output : 1.5 V

# MB84VD2108XEM/2109XEM-70

## • Read Cycle (Flash)



# MB84VD2108XEM/2109XEM-70

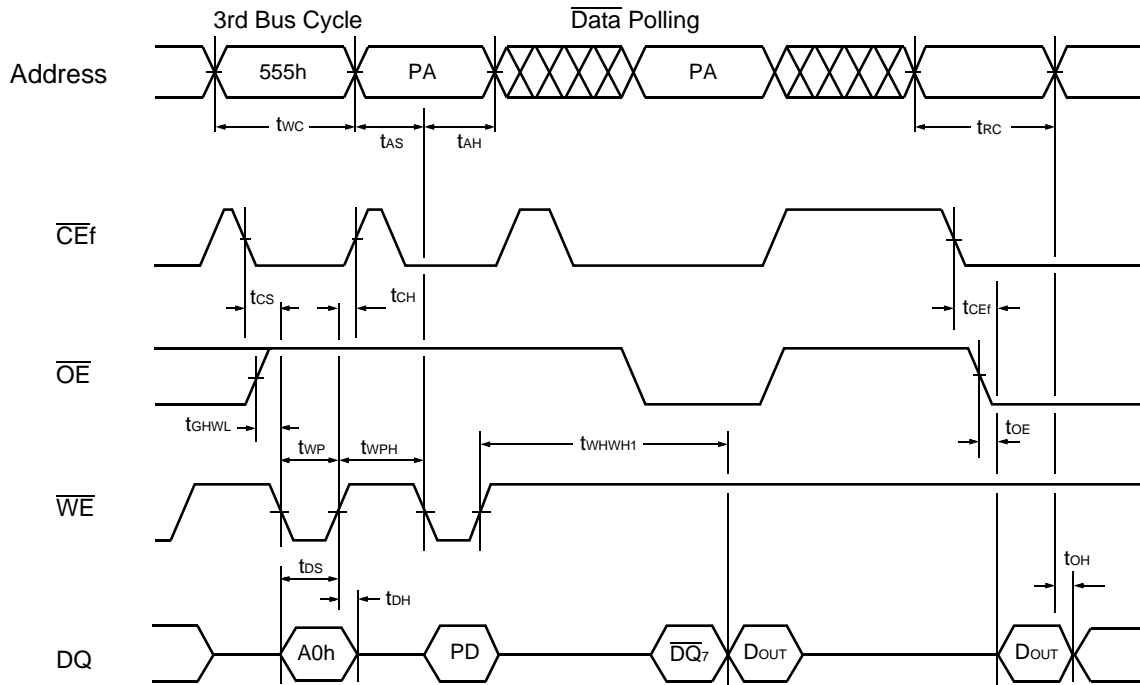
## • Erase/Program Operations (Flash)

Parameter	Symbol		Value			Unit
	JEDEC	Standard	Min	Typ	Max	
Write Cycle Time	t <sub>AVAV</sub>	t <sub>WC</sub>	70	—	—	ns
Address Setup Time ( $\overline{WE}$ to Addr.)	t <sub>AVWL</sub>	t <sub>AS</sub>	0	—	—	ns
Address Setup Time to $\overline{CEf}$ Low During Toggle Bit Polling	—	t <sub>ASO</sub>	12	—	—	ns
Address Hold Time ( $\overline{WE}$ to Addr.)	t <sub>WLAX</sub>	t <sub>AH</sub>	45	—	—	ns
Address Hold Time from $\overline{CEf}$ or $\overline{OE}$ High During Toggle Bit Polling	—	t <sub>AHT</sub>	0	—	—	ns
Data Setup Time	t <sub>DVWH</sub>	t <sub>DS</sub>	30	—	—	ns
Data Hold Time	t <sub>WDHX</sub>	t <sub>DH</sub>	0	—	—	ns
Output Enable Setup Time	—	t <sub>OES</sub>	0	—	—	ns
Output Enable Hold Time	Read	t <sub>OEH</sub>	0	—	—	ns
	Toggle and Data Polling		10	—	—	ns
$\overline{CEf}$ High During Toggle Bit Polling	—	t <sub>CEPH</sub>	20	—	—	ns
$\overline{OE}$ High During Toggle Bit Polling	—	t <sub>OEPH</sub>	20	—	—	ns
Read Recover Time Before Write ( $\overline{OE}$ to $\overline{CEf}$ )	t <sub>GHEL</sub>	t <sub>GHEL</sub>	0	—	—	ns
Read Recover Time Before Write ( $\overline{OE}$ to $\overline{WE}$ )	t <sub>GHWL</sub>	t <sub>GHWL</sub>	0	—	—	ns
$\overline{WE}$ Setup Time ( $\overline{CEf}$ to $\overline{WE}$ )	t <sub>WLWL</sub>	t <sub>WS</sub>	0	—	—	ns
$\overline{CEf}$ Setup Time ( $\overline{WE}$ to $\overline{CEf}$ )	t <sub>ELWL</sub>	t <sub>CS</sub>	0	—	—	ns
$\overline{WE}$ Hold Time ( $\overline{CEf}$ to $\overline{WE}$ )	t <sub>EHWH</sub>	t <sub>WH</sub>	0	—	—	ns
$\overline{CEf}$ Hold Time ( $\overline{WE}$ to $\overline{CEf}$ )	t <sub>WHEH</sub>	t <sub>CH</sub>	0	—	—	ns
Write Pulse Width	t <sub>WLWH</sub>	t <sub>WP</sub>	35	—	—	ns
$\overline{CEf}$ Pulse Width	t <sub>LELH</sub>	t <sub>CP</sub>	35	—	—	ns
Write Pulse Width High	t <sub>WHWL</sub>	t <sub>WPH</sub>	25	—	—	ns
$\overline{CEf}$ Pulse Width High	t <sub>EHEL</sub>	t <sub>CPH</sub>	25	—	—	ns
Byte Programming Operation	t <sub>WHWH1</sub>	t <sub>WHWH1</sub>	—	8	—	μs
Word Programming Operation			—	16	—	μs
Sector Erase Operation *1	t <sub>WHWH2</sub>	t <sub>WHWH2</sub>	—	1	—	s
V <sub>ccf</sub> Setup Time	—	t <sub>VCS</sub>	50	—	—	μs
Voltage Transition Time *2	—	t <sub>VLHT</sub>	4	—	—	μs
Rise Time to V <sub>ID</sub> *2	—	t <sub>VIDR</sub>	500	—	—	ns
Rise Time to V <sub>ACC</sub>	—	t <sub>VACCR</sub>	500	—	—	ns
Recover Time from RY/ $\overline{BY}$	—	t <sub>RB</sub>	0	—	—	ns
RESET Pulse Width	—	t <sub>RP</sub>	500	—	—	ns
Delay Time from Embedded Output Enable	—	t <sub>EOE</sub>	—	—	70	ns
RESET Hold Time Before Read	—	t <sub>RH</sub>	200	—	—	ns
Program/Erase Valid to RY/ $\overline{BY}$ Delay	—	t <sub>BUSY</sub>	—	—	90	ns
Erase Time-out Time *3	—	t <sub>TOW</sub>	50	—	—	μs
Erase Suspend Transition Time *4	—	t <sub>SPD</sub>	—	—	20	μs

# MB84VD2108XEM/2109XEM-70

- \*1 : This does not include the preprogramming time.
- \*2 : This timing is for Sector Protection Operation.
- \*3 : The time between writes must be less than “ $t_{row}$ ” otherwise that command will not be accepted and erasure will start. A time-out or “ $t_{row}$ ” from the rising edge of last  $\overline{CE}$  or  $\overline{WE}$  whichever happens first will initiate the execution of the Sector Erase command(s).
- \*4 : When the Erase Suspend command is written during the Sector Erase operation, the device will take a maximum of “ $t_{SPD}$ ” to suspend the erase operation.

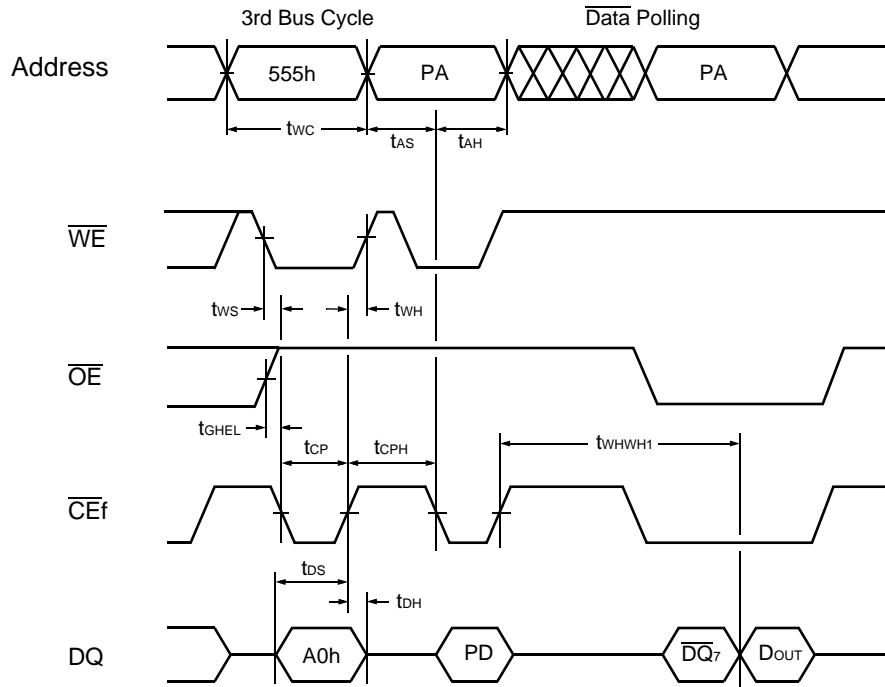
• Write Cycle ( $\overline{WE}$  control) (Flash)



- Notes :
- PA is address of the memory location to be programmed.
  - PD is data to be programmed at byte address.
  - $\overline{DQ}_7$  is the output of the complement of the data written to the device.
  - D<sub>OUT</sub> is the output of the data written to the device.
  - Figure indicates last two bus cycles out of four bus cycle sequence.
  - These waveforms are for the x16 mode. (The addresses differ from x8 mode.)

# MB84VD2108XEM/2109XEM-70

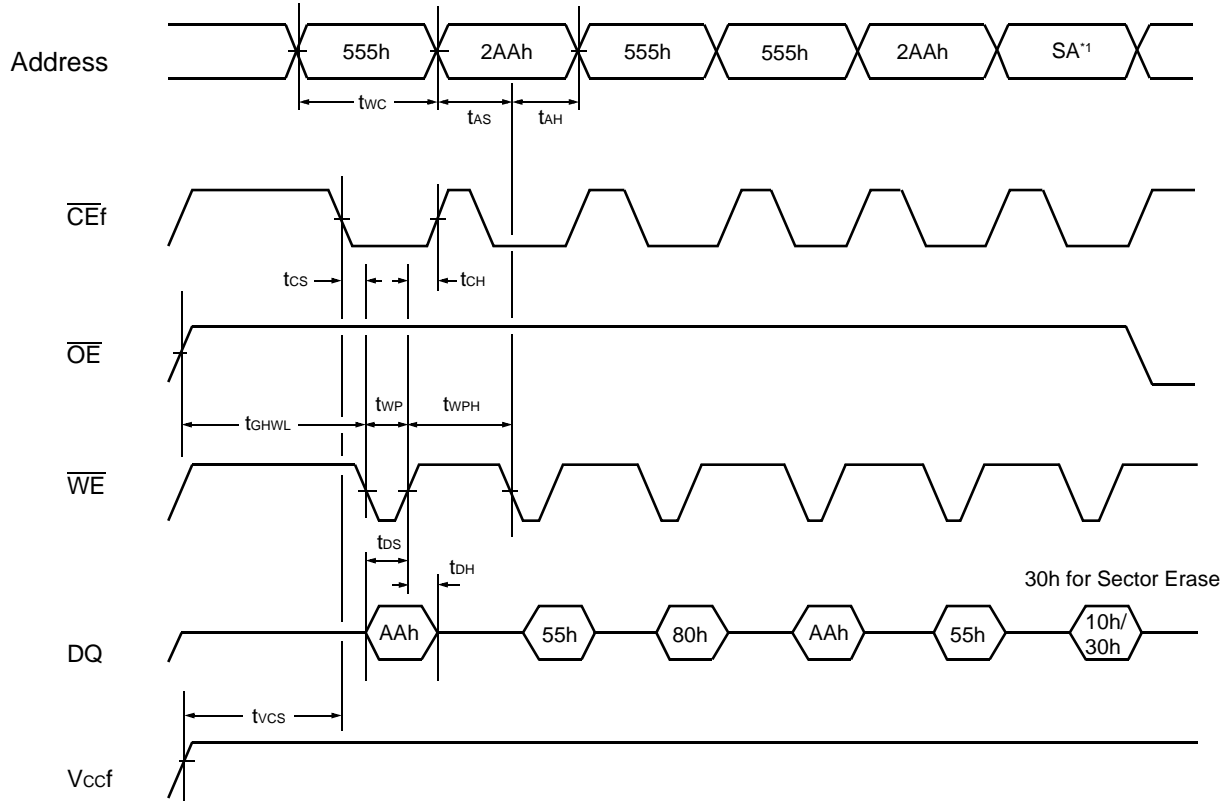
## • Write Cycle ( $\overline{\text{CEf}}$ control) (Flash)



- Notes :
- PA is address of the memory location to be programmed.
  - PD is data to be programmed at byte address.
  - $\overline{\text{DQ}}_7$  is the output of the complement of the data written to the device.
  - $\text{D}_{OUT}$  is the output of the data written to the device.
  - Figure indicates last two bus cycles out of four bus cycle sequence.
  - These waveforms are for the x16 mode. (The addresses differ from x8 mode.)



## • AC Waveforms Chip/Sector Erase Operations (Flash)

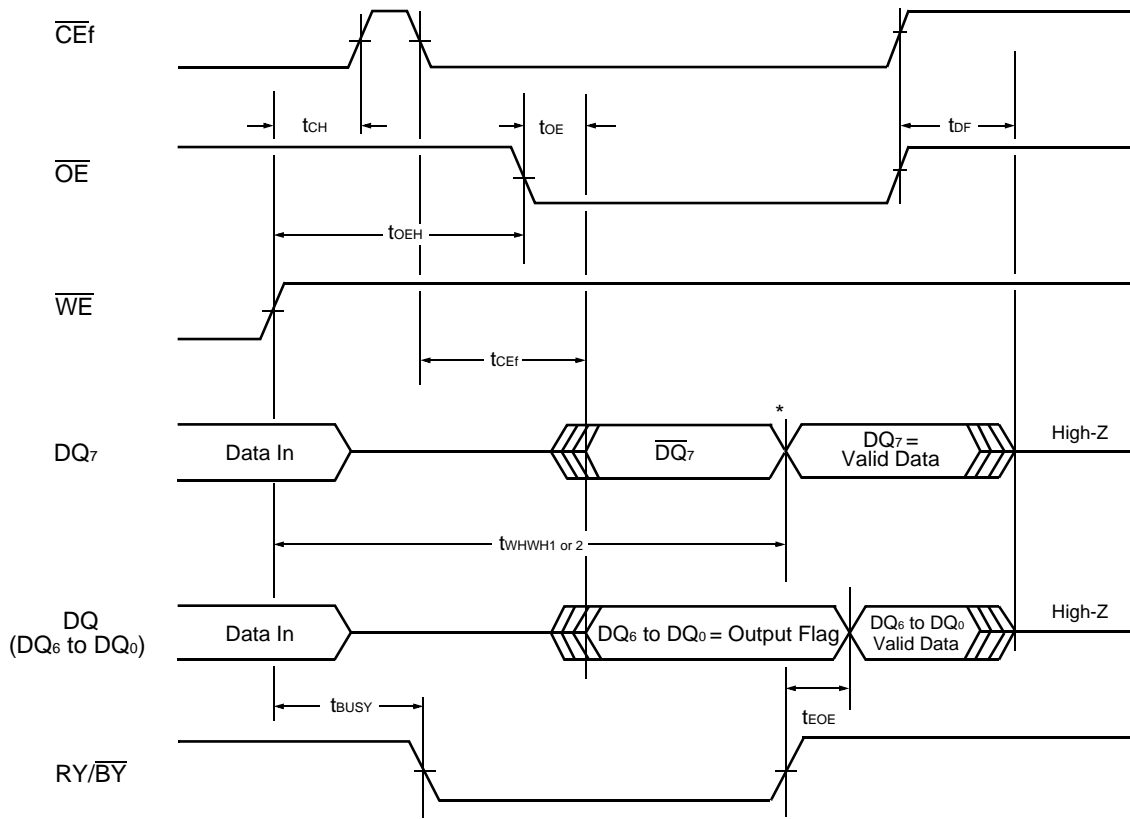


\* : SA is the sector address for Sector Erase. Addresses = 555h for Chip Erase.

Note : These waveform are for the x16 mode. (The addresses differ from x8 mode.)

# MB84VD2108XEM/2109XEM-70

## • AC Waveforms for $\overline{\text{Data Polling}}$ during Embedded Algorithm Operations (Flash)

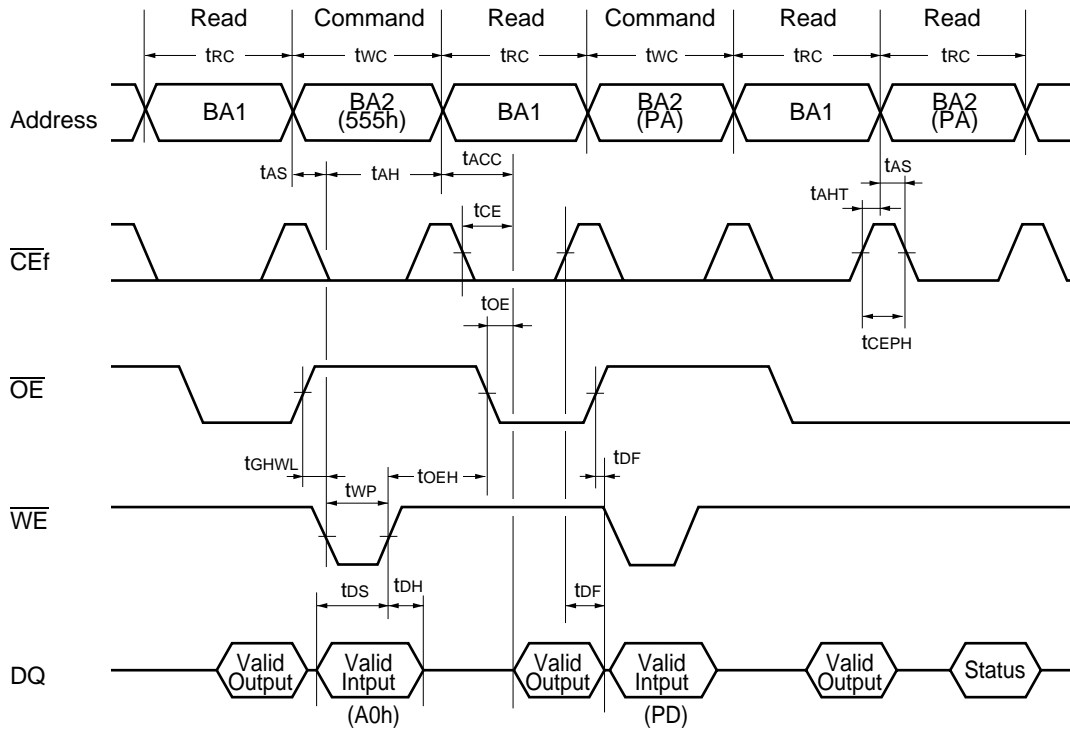


\* :  $\text{DQ}_7 = \text{Valid Data}$  (The device has completed the Embedded operation.)



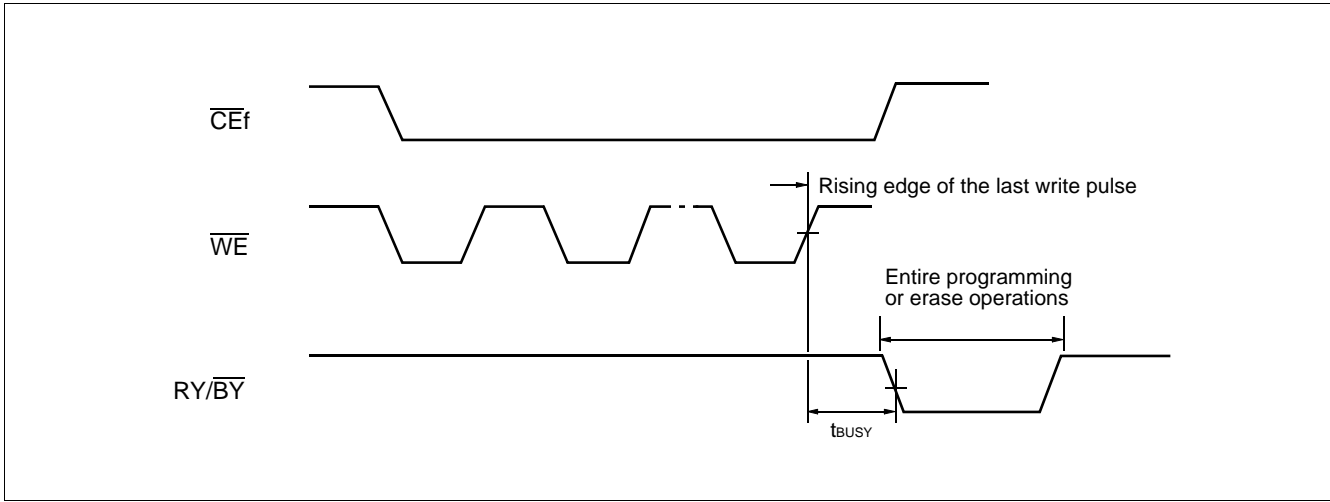
# MB84VD2108XEM/2109XEM-70

## • Bank-to-bank Read/Write Timing Diagram (Flash)

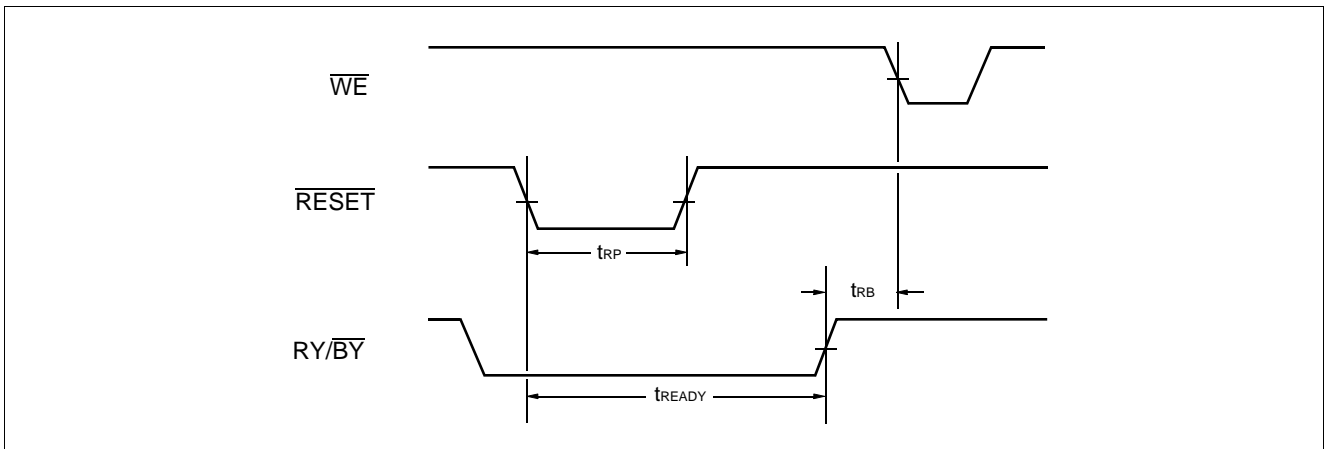


Note : This is example of Read for Bank 1 and Embedded Algorithm (program) for Bank 2.  
 BA1: Address of Bank 1.  
 BA2: Address of Bank 2.

- **$\overline{RY}/\overline{BY}$  Timing Diagram during Write/Erase Operations (Flash)**

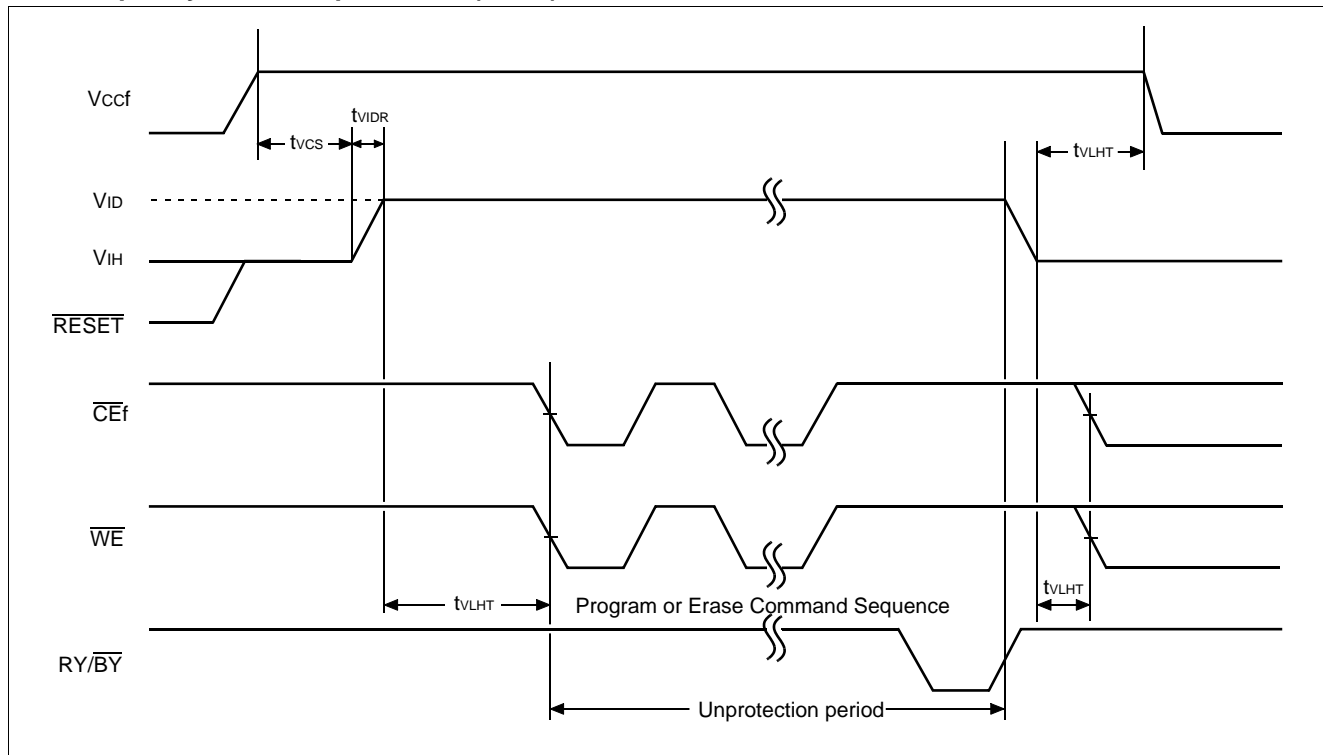


- **$\overline{RESET}$ ,  $\overline{RY}/\overline{BY}$  Timing Diagram (Flash)**

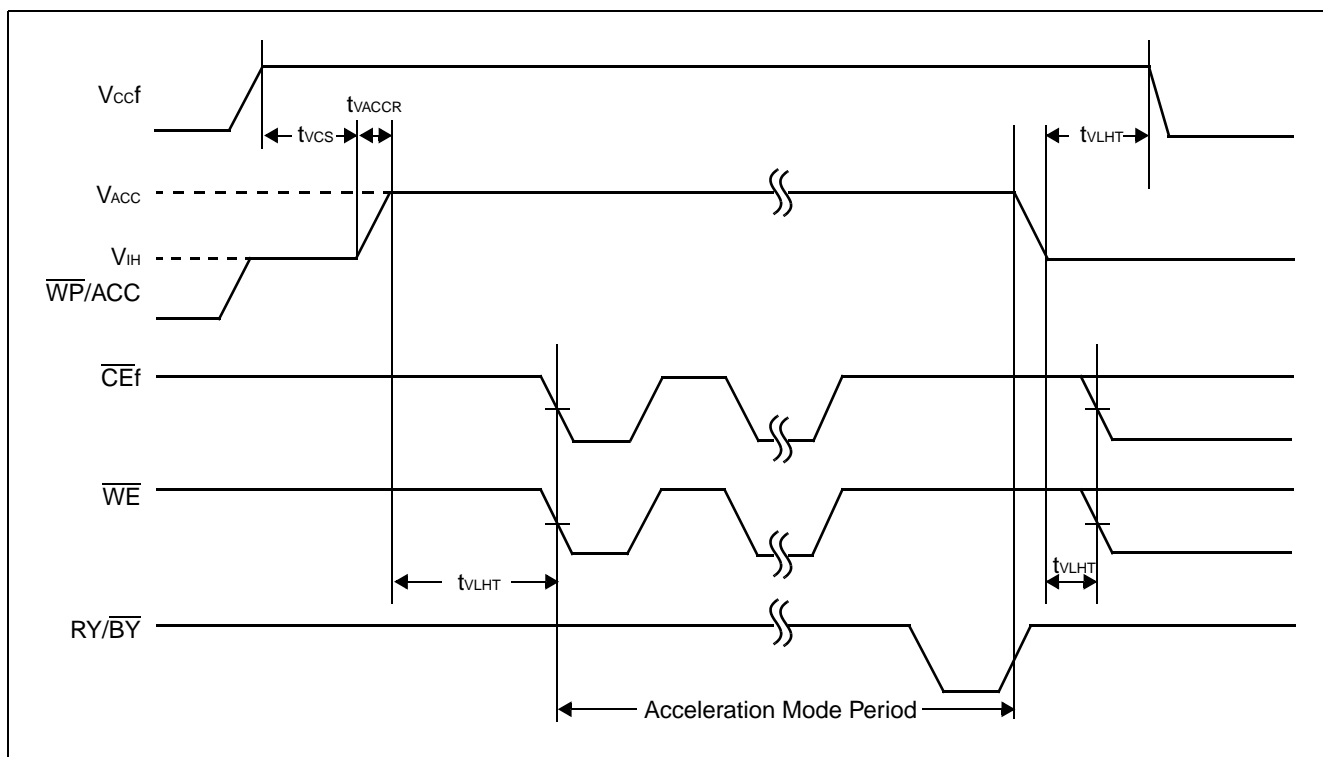


# MB84VD2108XEM/2109XEM-70

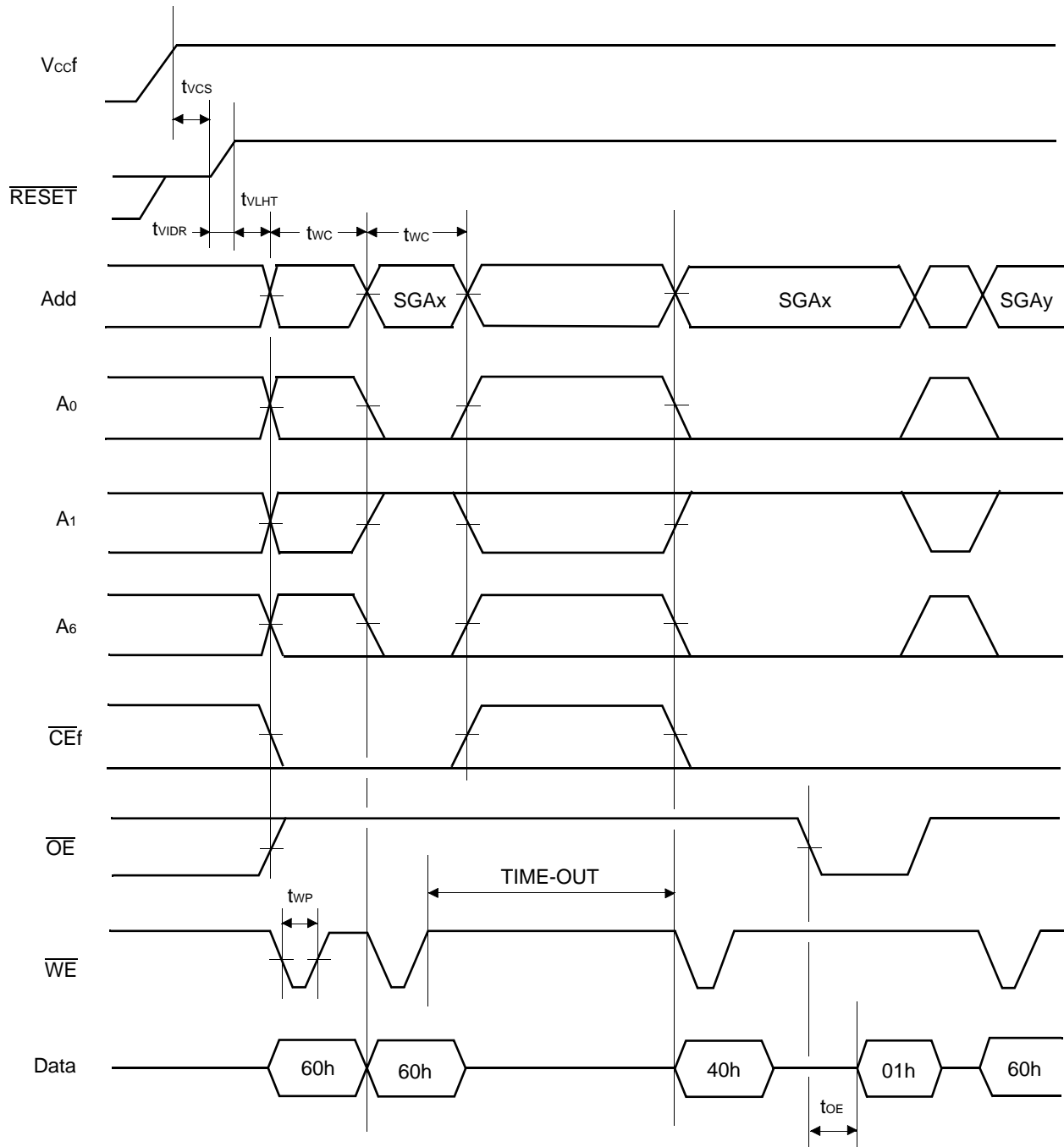
## • Temporary Sector Unprotection (Flash)



## • Acceleration Mode Timing Diagram (Flash)



• Extended Sector Protection (Flash)



$SGAx$  : Sector Group Address to be protected  
 $SGAy$  : Next Group Sector Address to be protected  
**TIME-OUT** : Time-Out window = 250  $\mu s$  (Min)

# MB84VD2108XEM/2109XEM-70

## 2. Erase and Programming Performance (Flash)

Parameter	Limit			Unit	Comment
	Min	Typ	Max		
Sector Erase Time	—	1	10	s	Excludes programming time prior to erasure
Byte Programming Time	—	8	300	μs	Excludes system-level overhead
Word Programming Time	—	16	360	μs	Excludes system-level overhead
Chip Programming Time	—	—	50	s	Excludes system-level overhead
Erase/Program Cycle	100,000	—	—	cycle	



## ■ 2M SRAM CHARACTERISTICS for MCP

### 1. AC Characteristics

- Read Cycle (SRAM)

Parameter	Symbol	Value		Unit
		Min	Max	
Read Cycle Time	$t_{RC}$	70	—	ns
Address Access Time	$t_{AA}$	—	70	ns
Chip Enable ( $\overline{CE1s}$ ) Access Time	$t_{CO1}$	—	70	ns
Chip Enable (CE2s) Access Time	$t_{CO2}$	—	70	ns
Output Enable Access Time	$t_{OE}$	—	35	ns
$\overline{LB}$ , $\overline{UB}$ to Output Valid	$t_{BA}$	—	70	ns
Chip Enable ( $\overline{CE1s}$ Low and CE2s High) to Output Active	$t_{COE}$	5	—	ns
Output Enable Low to Output Active	$t_{OEE}$	0	—	ns
$\overline{UB}$ , $\overline{LB}$ Enable Low to Output Active	$t_{BE}$	0	—	ns
Chip Enable ( $\overline{CE1s}$ High or CE2s Low) to Output High-Z	$t_{OD}$	—	25	ns
Output Enable High to Output High-Z	$t_{ODO}$	—	25	ns
$\overline{UB}$ , $\overline{LB}$ Output Enable to Output High-Z	$t_{BD}$	—	25	ns
Output Data Hold Time	$t_{OH}$	10	—	ns

Note: Test Conditions

Output Load: 1 TTL gate and 30 pF

Input rise and fall times: 5 ns

Input pulse levels: 0.0 V to  $V_{CCS}$

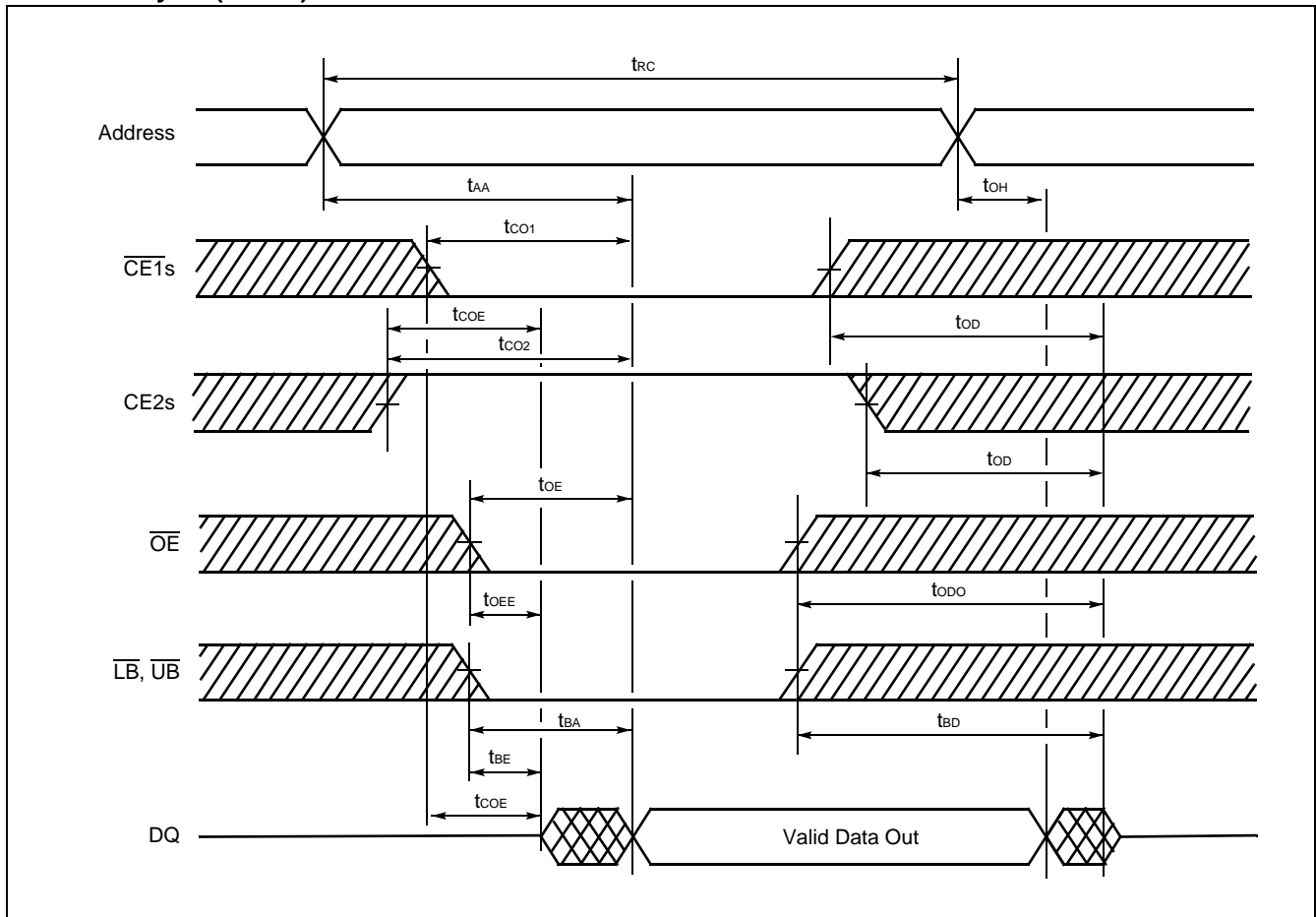
Timing measurement reference level

Input:  $0.5 \times V_{CCS}$

Output:  $0.5 \times V_{CCS}$

# MB84VD2108XEM/2109XEM-70

## • Read Cycle (SRAM)



Note :  $\overline{WE}$  remains "H" for the read cycle.

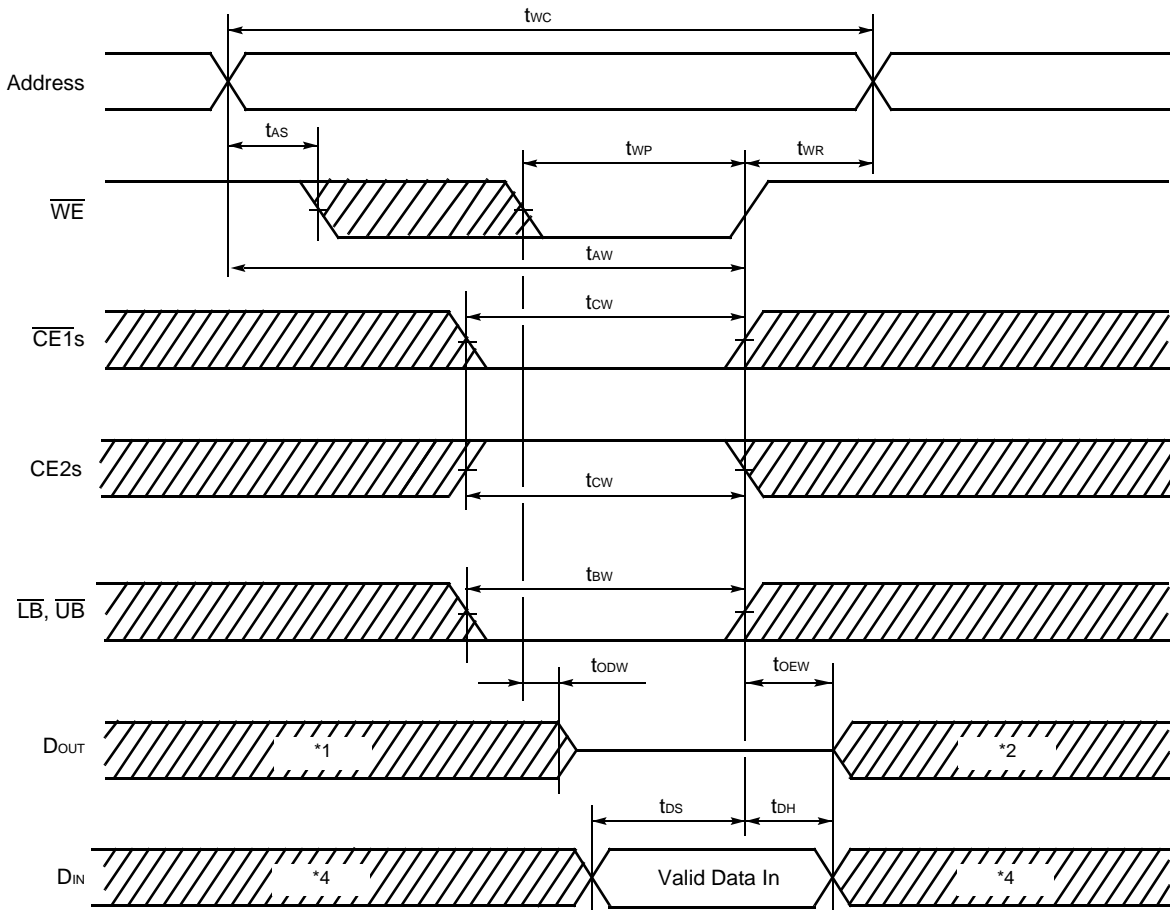
# MB84VD2108XEM/2109XEM-70

## • Write Cycle (SRAM)

Parameter	Symbol	Value		Unit
		Min	Max	
Write Cycle Time	t <sub>WC</sub>	70	—	ns
Write Pulse Width	t <sub>WP</sub>	50	—	ns
Chip Enable to End of Write	t <sub>CW</sub>	55	—	ns
Address valid to End of Write	t <sub>AW</sub>	55	—	ns
$\overline{UB}$ , $\overline{LB}$ to End of Write	t <sub>BW</sub>	55	—	ns
Address Setup Time	t <sub>AS</sub>	0	—	ns
Write Recovery Time	t <sub>WR</sub>	0	—	ns
$\overline{WE}$ Low to Output High-Z	t <sub>ODW</sub>	—	25	ns
$\overline{WE}$ High to Output Active	t <sub>OEW</sub>	0	—	ns
Data Setup Time	t <sub>DS</sub>	30	—	ns
Data Hold Time	t <sub>DH</sub>	0	—	ns

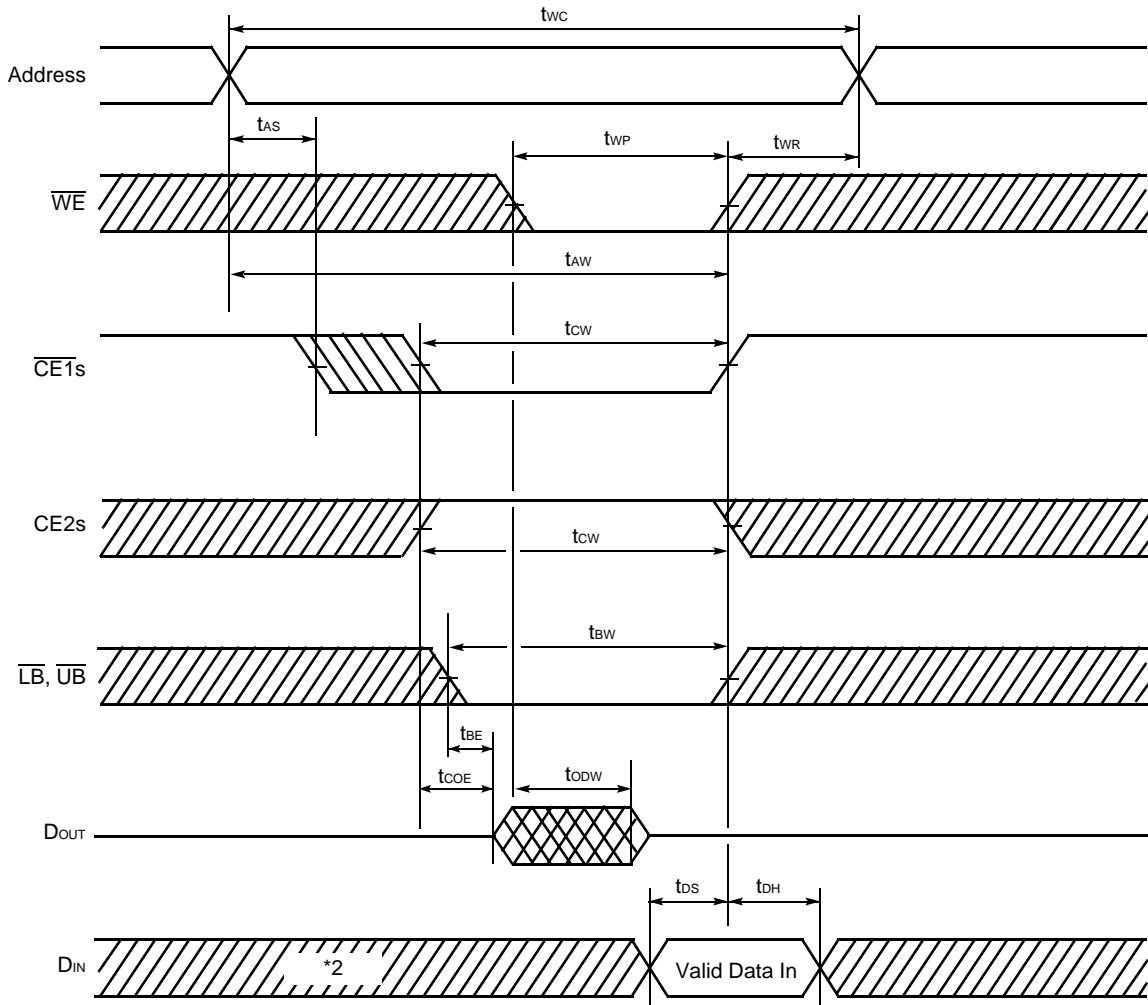
# MB84VD2108XEM/2109XEM-70

## • Write Cycle \*3 ( $\overline{WE}$ control) (SRAM)



- \*1 : If  $\overline{CE1s}$  goes "L" (or  $\overline{CE2s}$  goes "H") coincident with or after  $\overline{WE}$  goes "L", the output will remain at High-Z.
- \*2 : If  $\overline{CE1s}$  goes "H" (or  $\overline{CE2s}$  goes "L") coincident with or before  $\overline{WE}$  goes "H", the output will remain at High-Z.
- \*3 : If  $\overline{OE}$  is "H" during the write cycle, the outputs will remain at High-Z.
- \*4 : Because I/O signals may be in the output state at this Time, input signals of reverse polarity must not be applied.

• Write Cycle \*1 ( $\overline{CE1s}$  control) (SRAM)

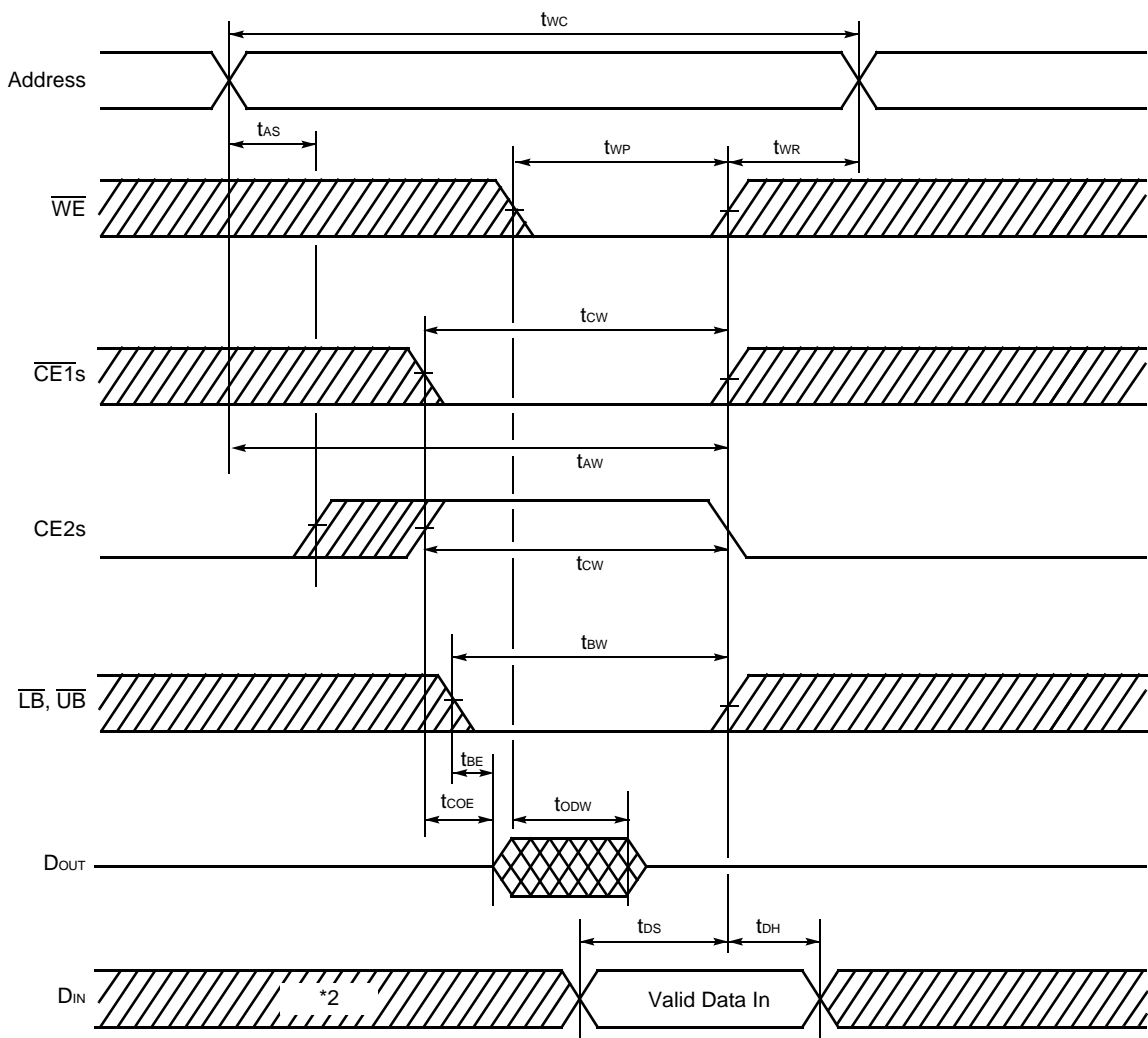


\*1 : If  $\overline{OE}$  is "H" during the write cycle, the outputs will remain at High-Z.

\*2 : Because I/O signals may be in the output state at this Time, input signals of reverse polarity must not be applied.

# MB84VD2108XEM/2109XEM-70

## • Write Cycle \*1 (CE2s Control) (SRAM)

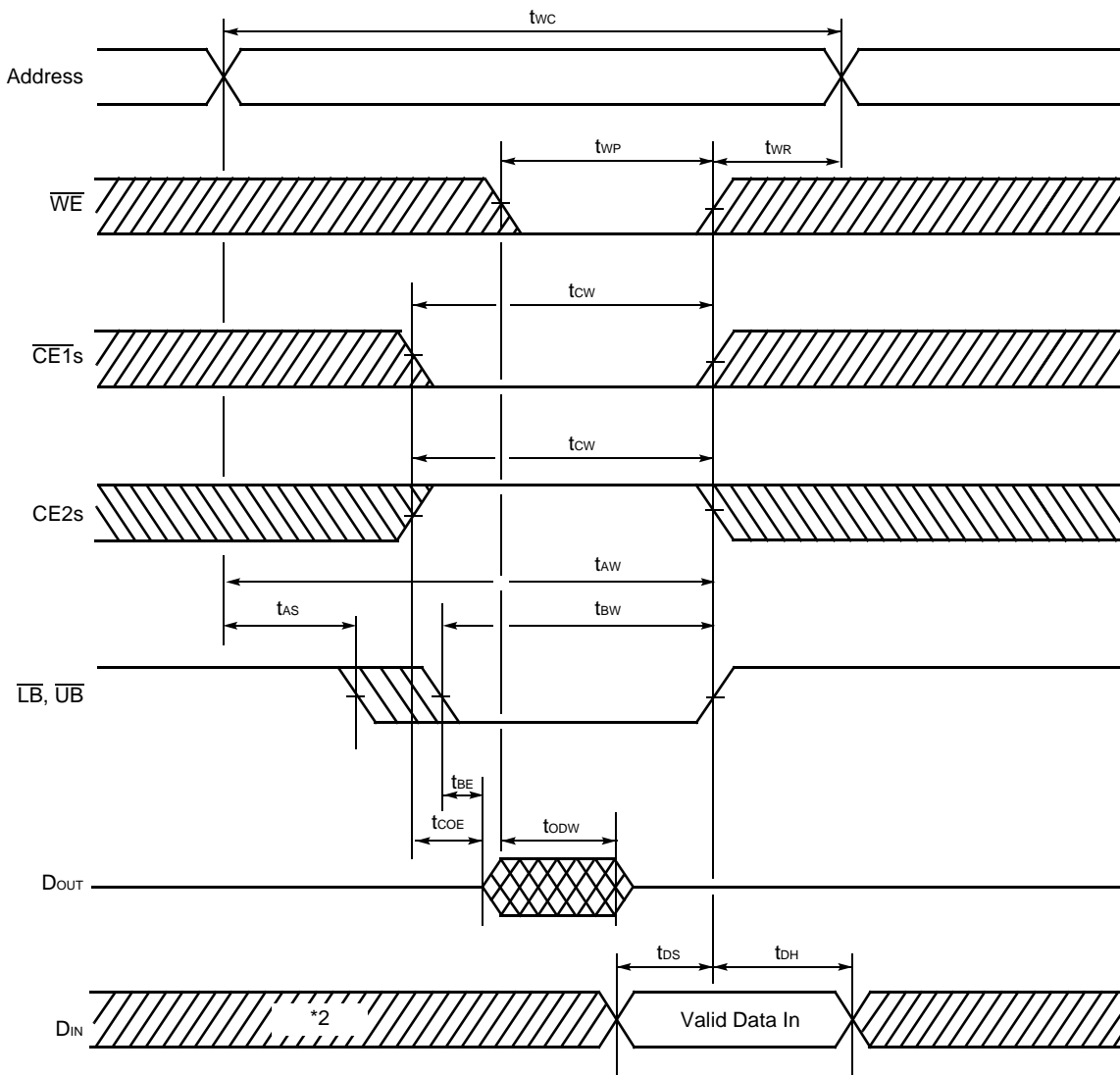


\*1 : If  $\overline{OE}$  is "H" during the write cycle, the outputs will remain at High-Z.

\*2 : Because I/O signals may be in the output state at this Time, input signals of reverse polarity must not be applied.

# MB84VD2108XEM/2109XEM-70

## • Write Cycle \*1 ( $\overline{LB}$ , $\overline{UB}$ Control) (SRAM)



\*1 : If  $\overline{OE}$  is "H" during the write cycle, the outputs will remain at High-Z.

\*2 : Because I/O signals may be in the output state at this Time, input signals of reverse polarity must not be applied.

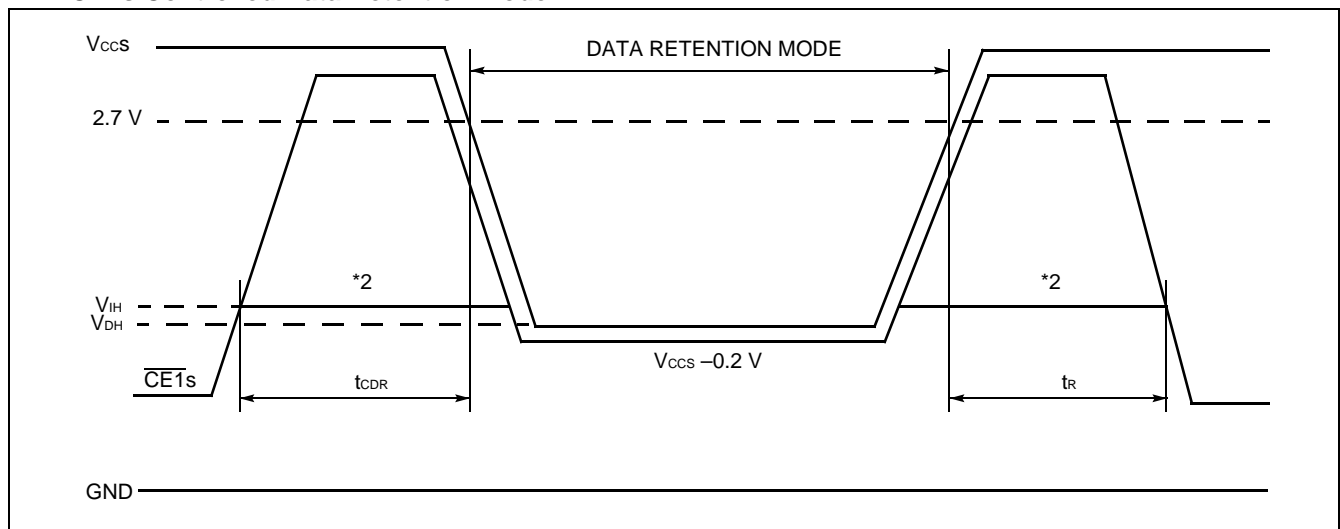
# MB84VD2108XEM/2109XEM-70

## 2. Data Retention Characteristics (SRAM)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Data Retention Supply Voltage	$V_{DH}$	1.5	—	3.3	V
Standby Current	$I_{DDs2}$	—	1	4	$\mu A$
Chip Deselect to Data Retention Mode Time	$t_{CDR}$	0	—	—	ns
Recovery Time	$t_r$	$t_{RC}$	—	—	ns

Note :  $t_{RC}$  : Read cycle time

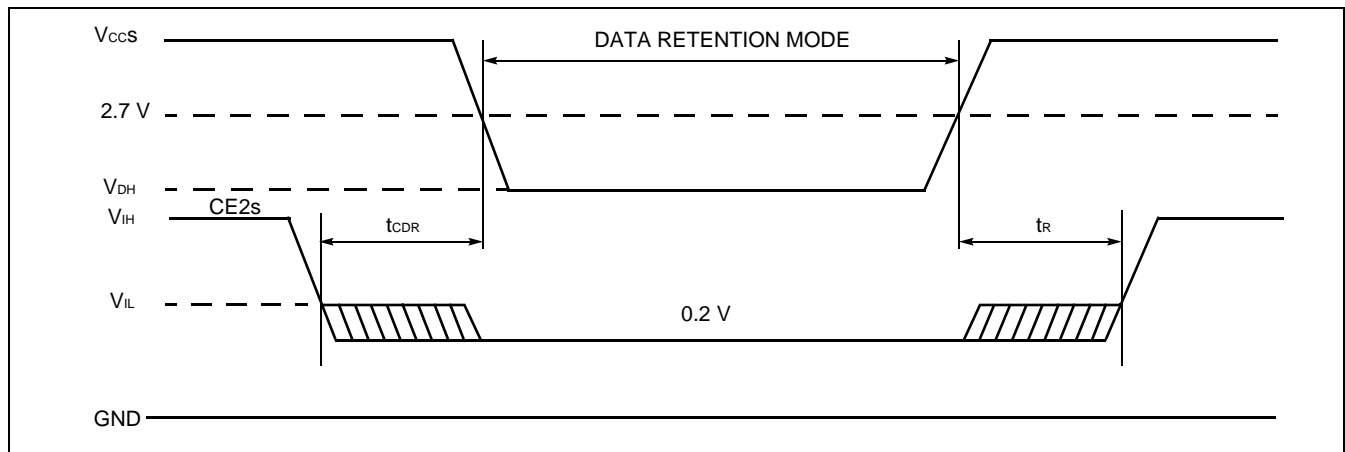
### • $\overline{CE1}$ s Controlled Data Retention Mode \*1



\*1 : In  $\overline{CE1}$ s controlled data retention mode, input level of  $\overline{CE2}$ s should be fixed  $V_{ccs}$  to  $V_{ccs}-0.2$  V or  $V_{ss}$  to 0.2 V during data retention mode. Other input and input/output pins can be used between  $-0.3$  V to  $V_{ccs}+0.3$  V.

\*2 : When  $\overline{CE1}$ s is operating at the  $V_{IH}$  Min level (2.2 V), the standby current is given by  $I_{SB1S}$  during the transition of  $V_{ccs}$  from 3.3 V to 2.2 V.

### • $\overline{CE2}$ s Controlled Data Retention Mode \*



\* : In  $\overline{CE2}$ s controlled data retention mode, input and input/output pins can be used between  $-0.3$  V to  $V_{ccs}+0.3$  V.



## ■ PIN CAPACITANCE

Parameter	Symbol	Test Setup	Value		Unit
			Typ	Max	
Input Capacitance	$C_{IN}$	$V_{IN} = 0$	11	14	pF
Output Capacitance	$C_{OUT}$	$V_{OUT} = 0$	12	16	pF
Control Pin Capacitance	$C_{IN2}$	$V_{IN} = 0$	14	16	pF
$\overline{WP}/ACC$ Pin Capacitance	$C_{IN3}$	$V_{IN} = 0$	17	20	pF

Note : Test conditions  $T_A = +25^\circ\text{C}$ ,  $f = 1.0 \text{ MHz}$

## ■ HANDLING OF PACKAGE

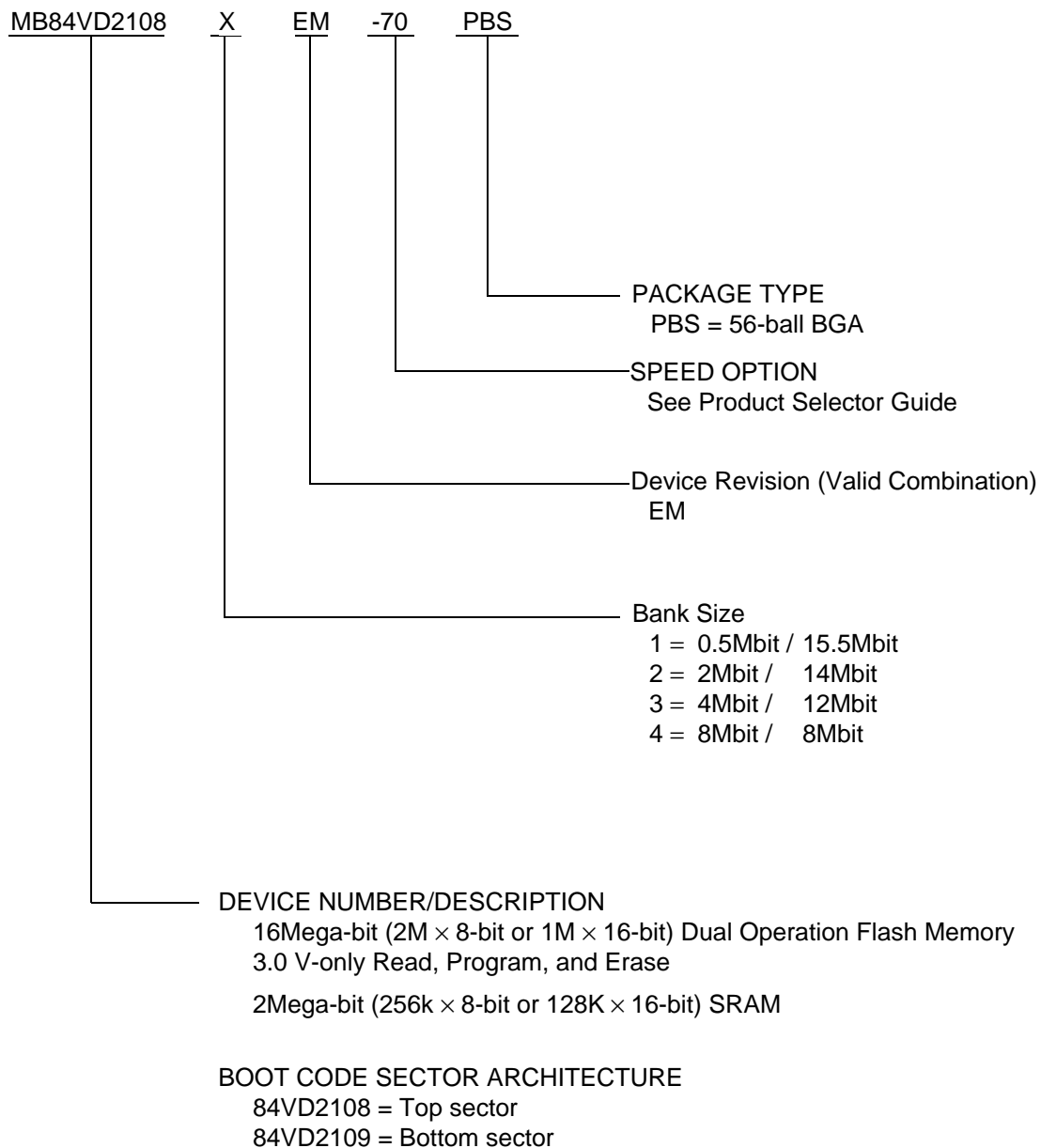
Please handle this package carefully since the sides of package create acute angles.

## ■ CAUTION

- The high voltage ( $V_{ID}$ ) cannot apply to address pins and control pins except  $\overline{RESET}$ .  
Exception is when autoselect and sector group protect function are used, then the high voltage ( $V_{ID}$ ) can be applied to  $\overline{RESET}$ .
- Without the high voltage ( $V_{ID}$ ), sector group protection can be achieved by using "Extended Sector Group Protection" command.

# MB84VD2108XEM/2109XEM-70

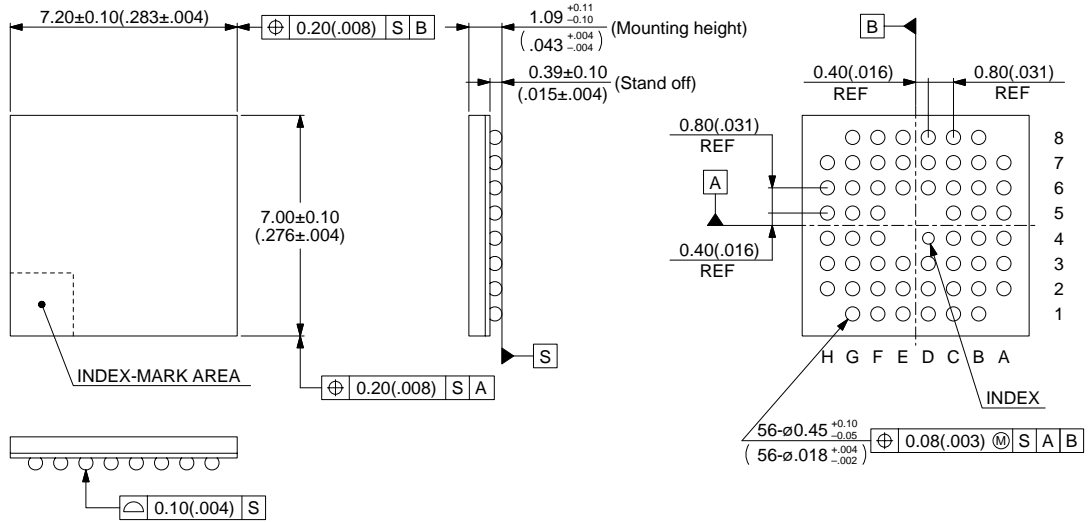
## ■ ORDERING INFORMATION



# MB84VD2108XEM/2109XEM-70

## ■ PACKAGE DIMENSION

56-pin plastic FBGA  
(BGA-56P-M02)



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Dimensions in mm (inches)

Note : The values in parentheses are reference values.

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