

## 512MB (64M x 64) / 1GB (2 x 64M x 64) NOR Flash Multi-Chip Package 3V Page Mode Memory

### FEATURES

- Single power supply operation
  - 3 Volt read, erase, and program operations
- I/O Control
  - Wide I/O voltage range ( $V_{IO}$ ): 1.8V to  $V_{CC}$
  - All input levels (address, control, and DQ input levels) and outputs are determined by voltage on  $V_{IO}$  input.
- Separate 1024-byte One Time Program (OTP) array with two lockable regions
- Uniform sector architecture
  - One thousand twenty four 128 Kbyte sectors
- 100,000 erase cycles per sector typical
- 20-year data retention typical
- Commercial, industrial and military temperature ranges
- Organized as 1 rank of 64M x 64 (512MB),  
2 ranks of 64M x 64 (1GB)

### PERFORMANCE CHARACTERISTICS

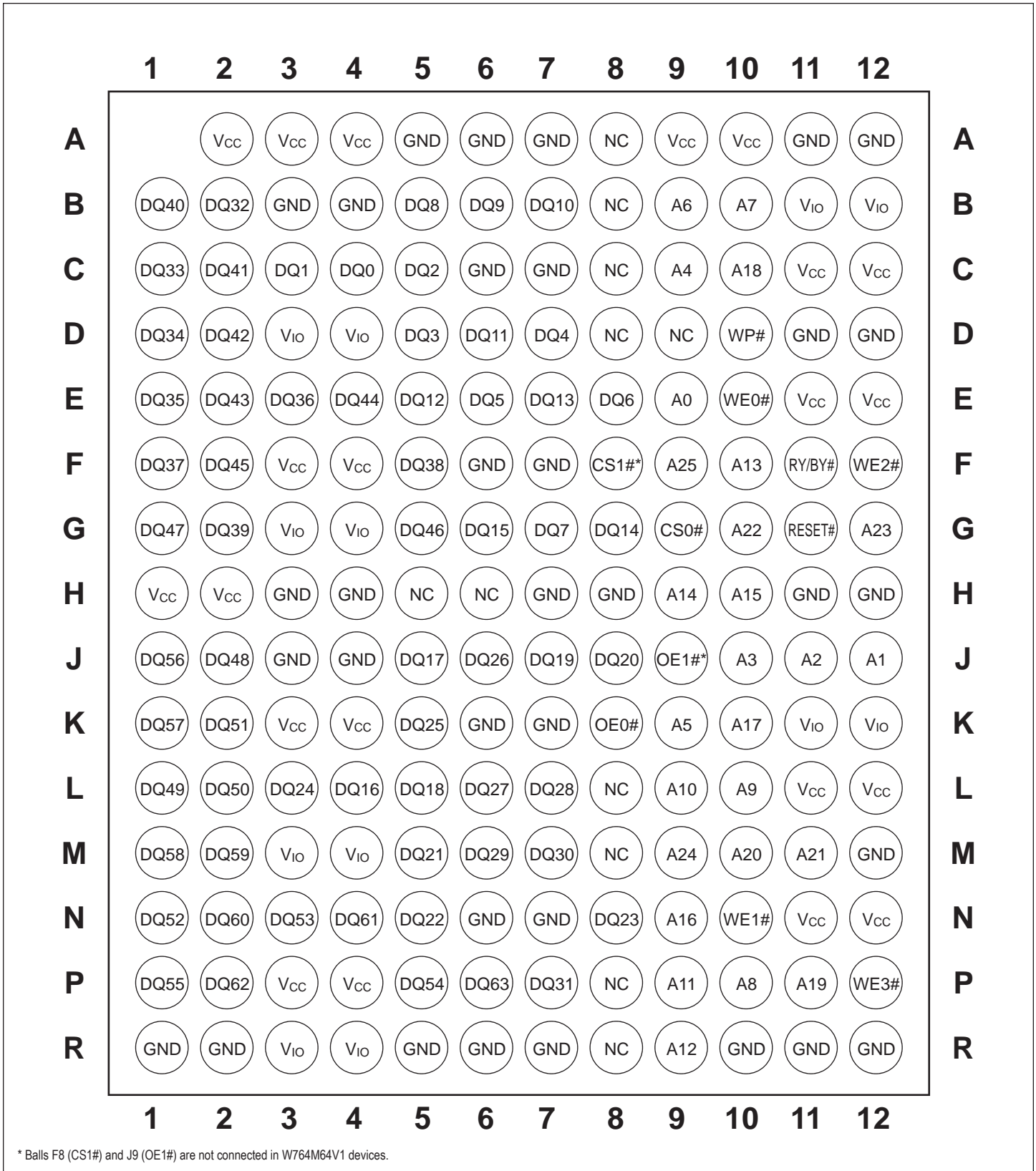
- High Performance
  - 110, 120 ns
  - 32-byte page read buffer
  - 15, 20 ns page read times
  - 512-byte write buffer reduces overall programming time for multiple-word updates
- Package option
  - 179 BGA, 14mm x 17mm
  - 1.0mm pitch
- Software features
  - Suspend and resume commands for program and erase operations
  - Data# polling and toggle bits provide status
  - CFI (Common Flash Interface) parameter table
- Hardware features
  - Advanced Sector Protection (ASP)
  - Hardware reset input (RESET#) resets device
  - Status Register, data polling, and ready/busy pin methods to determine device status.

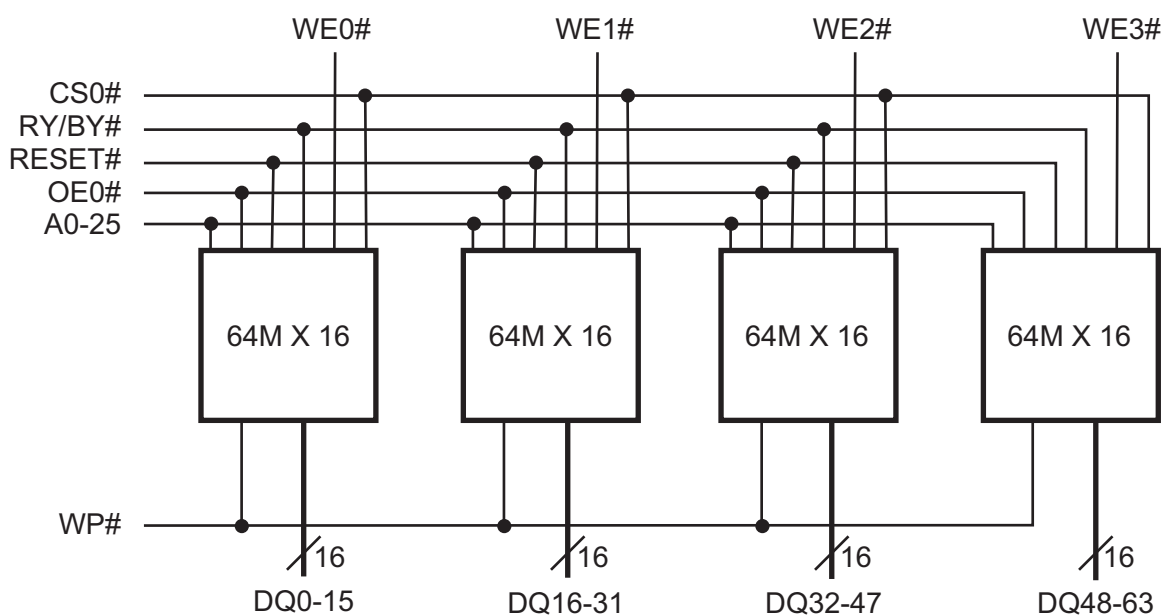
### GENERAL DESCRIPTION

The W764M64V1-XBX device is a 3V single power flash memory and utilizes four chips organized as 67,108,864 words. The W7264M64V1-XBX device is a 3V single power flash memory and utilizes eight chips organized as 67,108,864 words. These devices have a 64-bit wide data bus. One write enable per 16-bit data word.

Each device requires a single 3 volt power supply for both read and write functions.

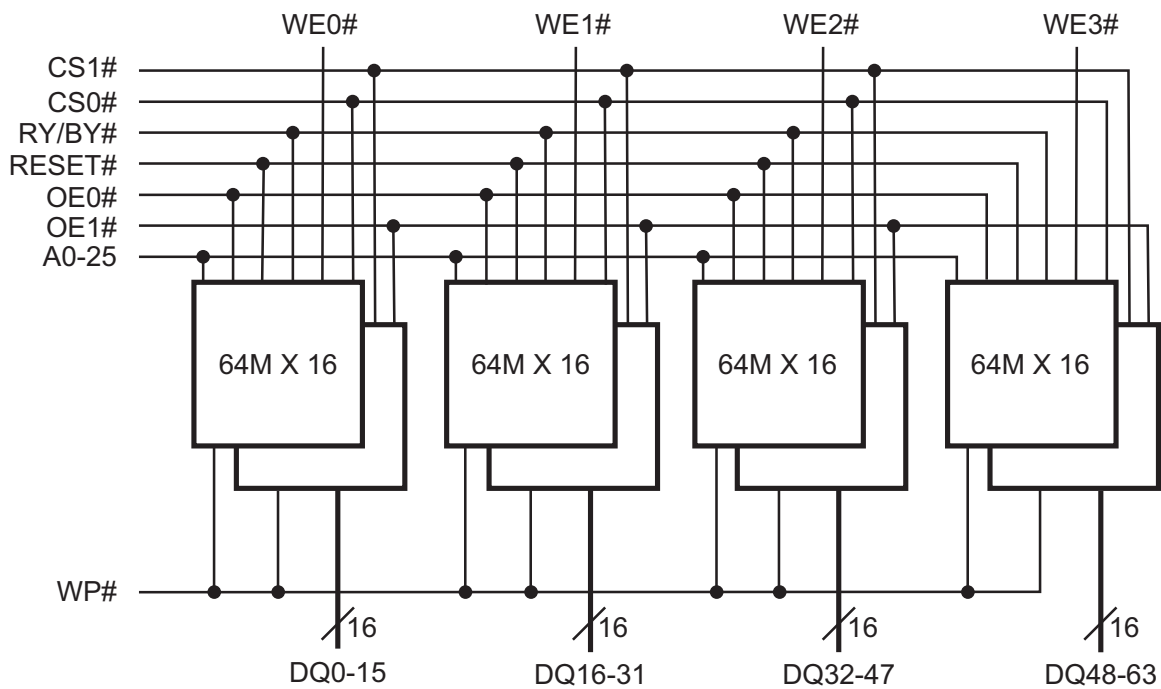
\* This product is under development, is not qualified or characterized and is subject to change or cancellation without notice.

**FIGURE 1 – PIN CONFIGURATION (TOP VIEW)**


**FIGURE 2 – W764M64V1 (512MB) BLOCK DIAGRAM**

**PIN DESCRIPTION**

DQ0-63	Data Inputs/Outputs
A0-25	Address Inputs
WE0-3#	Write Enables
CS0#	Chip Select
OE0#	Output Enable
RESET#	Hardware Reset
WP#	Hardware Write Protection
RY/BY#	Ready/Busy Output
V <sub>CC</sub>	Power Supply
V <sub>IO</sub>	I/O Power Supply
GND	Ground
DNU	Do Not Use
NC	Not Connected

FIGURE 3 – W7264M64V1 (1GB) BLOCK DIAGRAM



**PIN DESCRIPTION**

DQ0-63	Data Inputs/Outputs
A0-25	Address Inputs
WE0-3#	Write Enables
CS0-1#	Chip Select
OE0-1#	Output Enable
RESET#	Hardware Reset
WP#	Hardware Write Protection
RY/BY#	Ready/Busy Output
V <sub>CC</sub>	Power Supply
V <sub>IO</sub>	I/O Power Supply
GND	Ground
DNU	Do Not Use
NC	Not Connected

**ABSOLUTE MAXIMUM RATINGS**

Parameter		Unit
Supply Voltage Range ( $V_{CC}$ )	-0.5 to +4.0	V
Signal Voltage Range (other than RESET#)	-0.5 to $V_{IO} + 0.5$	V
I/O Voltage Range ( $V_{IO}$ )	-0.5 to +4.0	V
RESET#	-0.5 to $V_{CC} + 0.5$	V
Storage Temperature Range	-55 to +125	°C

- NOTES:
- Minimum DC voltage on input or input or I/Os is -0.5V. During voltage transitions, inputs or I/Os pins may overshoot GND to -2.0V for periods of up to 20ns. Maximum DC voltage on input or I/Os pins is  $V_{CC} + 0.5V$ . During voltage transitions, input or I/O pins may overshoot to  $V_{CC} + 2.0V$  for periods up to 20ns
  - Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational sections of the data sheet is not implied. Exposure of the device to absolute maximum rating conditions for extended periods may affect device reliability

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	$V_{CC}$	3.0	3.6	V
I/O Voltage	$V_{IO}$	1.7	$V_{CC} + 0.2$	V

**AC TEST CONDITIONS**

Parameter	Typ	Unit
Input Pulse Levels	$V_{IL} = 0, V_{IH} = V_{IO}$	V
Input Rise and Fall	1.5	ns
Input and Output Reference Level	$V_{IO} \times 0.5$	V
Output Timing Reference Level	$V_{IO} \times 0.5$	V

- NOTES:
- $I_{OL}$  &  $I_{OH}$  programmable from 0 to 16mA.  
Tester Impedance  $Z_0 = 50\Omega$ .  
 $V_Z$  is typically the midpoint of  $V_{OH}$  and  $V_{OL}$ .  
 $I_{OL}$  &  $I_{OH}$  are adjusted to simulate a typical resistive load circuit.  
ATE tester includes jig capacitance.

**W764M64V1 (512MB) BGA THERMAL RESISTANCE**

Description	Symbol	Typical	Units	Notes
Junction to Board	Theta JB	TBD	°C/W	1
Junction to Case (Top)	Theta JC	TBD	°C/W	1

The JEDEC JESD51 specifications are used as the default modeling environment and boundary conditions. Using still air, horizontal mounting and the 2s2p board. Published material properties are used as input to derive the thermal characteristics of the module. Your application conditions will most likely differ from the JESD51 2s2p board definition specifications; therefore, Microsemi PMG recommends a customized evaluation of thermal resistances based on the actual conditions in thermally-challenged situations. Delphi models are available for most products upon request.

**W7264M64V1 (1GB) BGA THERMAL RESISTANCE**

Description	Symbol	Typical	Units	Notes
Junction to Board	Theta JB	TBD	°C/W	1
Junction to Case (Top)	Theta JC	TBD	°C/W	1

The JEDEC JESD51 specifications are used as the default modeling environment and boundary conditions. Using still air, horizontal mounting and the 2s2p board. Published material properties are used as input to derive the thermal characteristics of the module. Your application conditions will most likely differ from the JESD51 2s2p board definition specifications; therefore, Microsemi PMG recommends a customized evaluation of thermal resistances based on the actual conditions in thermally-challenged situations. Delphi models are available for most products upon request.

**DC CHARACTERISTICS**

Parameter	Symbol	Conditions	Min	Max	Unit
Input Load Current (512MB)	I <sub>LI</sub>	V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub>		±4.0	µA
Output Leakage Current (512MB)	I <sub>LO</sub>	V <sub>OUT</sub> = V <sub>SS</sub> to V <sub>CC</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub>		±2.0	µA
Input Load Current (1GB)	I <sub>LI</sub>	V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub>		±8.0	µA
Output Leakage Current (1GB)	I <sub>LO</sub>	V <sub>OUT</sub> = V <sub>SS</sub> to V <sub>CC</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub>		±2.0	µA
V <sub>CC</sub> Active Current for Read (6)	I <sub>CC1</sub>	CS# = V <sub>IL</sub> , OE# = V <sub>IH</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub> ; address switching at 5MHz		240	mA
V <sub>CC</sub> Intra-Page Read Current (6)	I <sub>CC2</sub>	CS# = V <sub>IL</sub> #, OE# = V <sub>IH</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub> ; f = 33MHz		100	mA
V <sub>CC</sub> Active Erase/Program Current (1, 6)	I <sub>CC3</sub>	CS# = V <sub>IL</sub> #, OE# = V <sub>IH</sub> , V <sub>CC</sub> = V <sub>CC(MAX)</sub>		400	mA
V <sub>CC</sub> Standby Current (6)	I <sub>CC4</sub>	CS#, RESET#, OE# = V <sub>IH</sub> , V <sub>IH</sub> = V <sub>IO</sub> , V <sub>IL</sub> = V <sub>SS</sub> , V <sub>CC</sub> = V <sub>CC MAX</sub>		400	µA
V <sub>CC</sub> Reset Current (3, 5, 6)	I <sub>CC5</sub>	CS# = V <sub>IH</sub> , RESET# = V <sub>IL</sub> , V <sub>CC</sub> = V <sub>CC MAX</sub>		80	mA
Automatic Sleep Mode (2, 5, 6)	I <sub>CC6</sub>	V <sub>IH</sub> = V <sub>IO</sub> , V <sub>IL</sub> = V <sub>SS</sub> , V <sub>CC</sub> = V <sub>CC MAX</sub> , t <sub>ACC</sub> + 30 ns		24	mA
		V <sub>IH</sub> = V <sub>IO</sub> , V <sub>IL</sub> = V <sub>SS</sub> , V <sub>CC</sub> = V <sub>CC max</sub> , t <sub>ASSB</sub>		600	µA
V <sub>CC</sub> current during power up (5, 6)	I <sub>CC7</sub>	RESET# = V <sub>IO</sub> , CS# = V <sub>IO</sub> , V <sub>CC</sub> = V <sub>CC MAX</sub>		320	mA
Input Low Voltage	V <sub>IL</sub>		-0.5	0.3 x V <sub>IO</sub>	V
Input High Voltage	V <sub>IH</sub>		0.7 x V <sub>IO</sub>	V <sub>IO</sub> + 0.4	V
Output Low Voltage (4)	V <sub>OL</sub>	I <sub>OL</sub> = 100 µA for DQs, I <sub>OL</sub> = 2mA for RY/BY#		0.15 x V <sub>IO</sub>	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = 100 µA	0.85 x V <sub>IO</sub>		V
Low V <sub>CC</sub> Lock-Out Voltage (5)	V <sub>LKO</sub>		2.25	2.5	V

## NOTES:

- I<sub>CC</sub> active while Embedded Algorithm is in progress.
- Automatic sleep mode enables the lower power mode when addresses remain stable for the specified designated time.
- If an embedded operation is in progress at the start of reset, the current consumption will remain at the embedded operation specification until the embedded operation is stopped by the reset. If no embedded operation is in progress when reset is started, or following the stopping of an embedded operation, I<sub>CC7</sub> will be drawn during the remainder of t<sub>RPH</sub>. After the end of t<sub>RPH</sub> the device will go to standby mode until the next read or write.
- The recommended pull-up resistor for RY/BY# output is 5k to 10k Ohms.
- Guaranteed by design, not tested
- Current value is for 1-rank of 64-bit data flash only.

**AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS – WE# CONTROLLED**

Parameter	Symbol		-110		-120		Unit
			Min	Max	Min	Max	
Write Cycle Time	t <sub>AVAV</sub>	t <sub>WC</sub>	60		60		ns
Chip Select Setup Time	t <sub>ELWL</sub>	t <sub>CS</sub>	0		0		ns
Write Enable Pulse Width	t <sub>WLWH</sub>	t <sub>WP</sub>	25		25		ns
Address Setup Time	t <sub>AVWL</sub>	t <sub>AS</sub>	0		0		ns
Data Setup Time	t <sub>DVWH</sub>	t <sub>DS</sub>	30		30		ns
Data Hold Time	t <sub>WHDX</sub>	t <sub>DH</sub>	0		0		ns
Address Hold Time	t <sub>WLAX</sub>	t <sub>AH</sub>	45		45		ns
Write Enable Pulse Width High (3)	t <sub>WHWL</sub>	t <sub>WPH</sub>	20		20		ns
Single Word Programming Time (1)	t <sub>WHWH1</sub>			400		400	μs
Buffer Programming Time				750		750	μs
Sector Erase (2)	t <sub>WHWH2</sub>			1.1		1.1	sec
Read Recovery Time before Write (3)	t <sub>GHWL</sub>		0		0		ns
Address Setup Time to OE# low during toggle bit polling		t <sub>ASO</sub>	15		15		ns
Write Recovery Time from RY/BY# (3)		t <sub>RB</sub>	0		0		ns
Program/Erase Valid to RY/BY# (3)		t <sub>BUSY</sub>		80		80	ns

## NOTES:

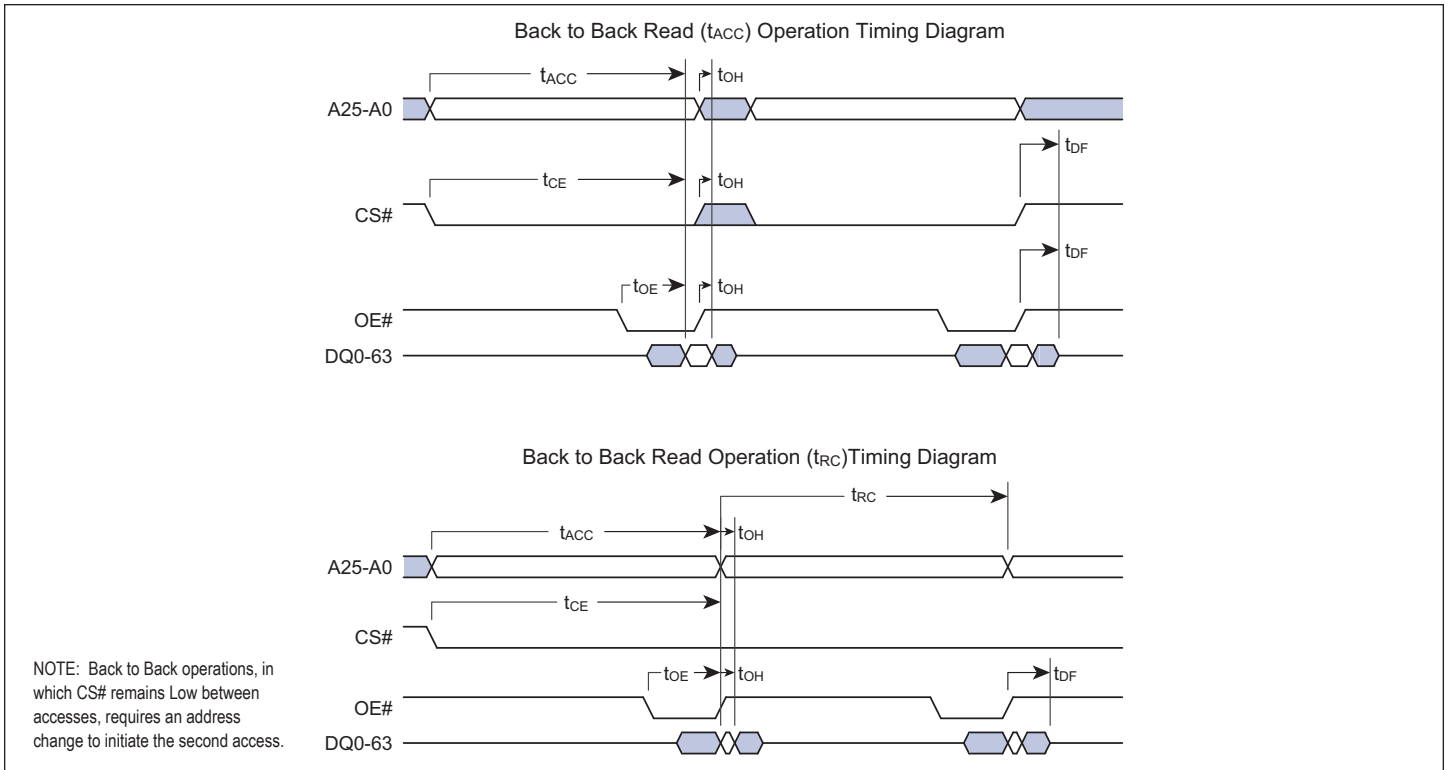
1. Typical value for t<sub>WHWH1</sub> is 125 μs.
2. Typical value for t<sub>WHWH2</sub> is 0.275 sec.
3. Guaranteed by design, not tested.

**AC CHARACTERISTICS – READ-ONLY OPERATIONS**

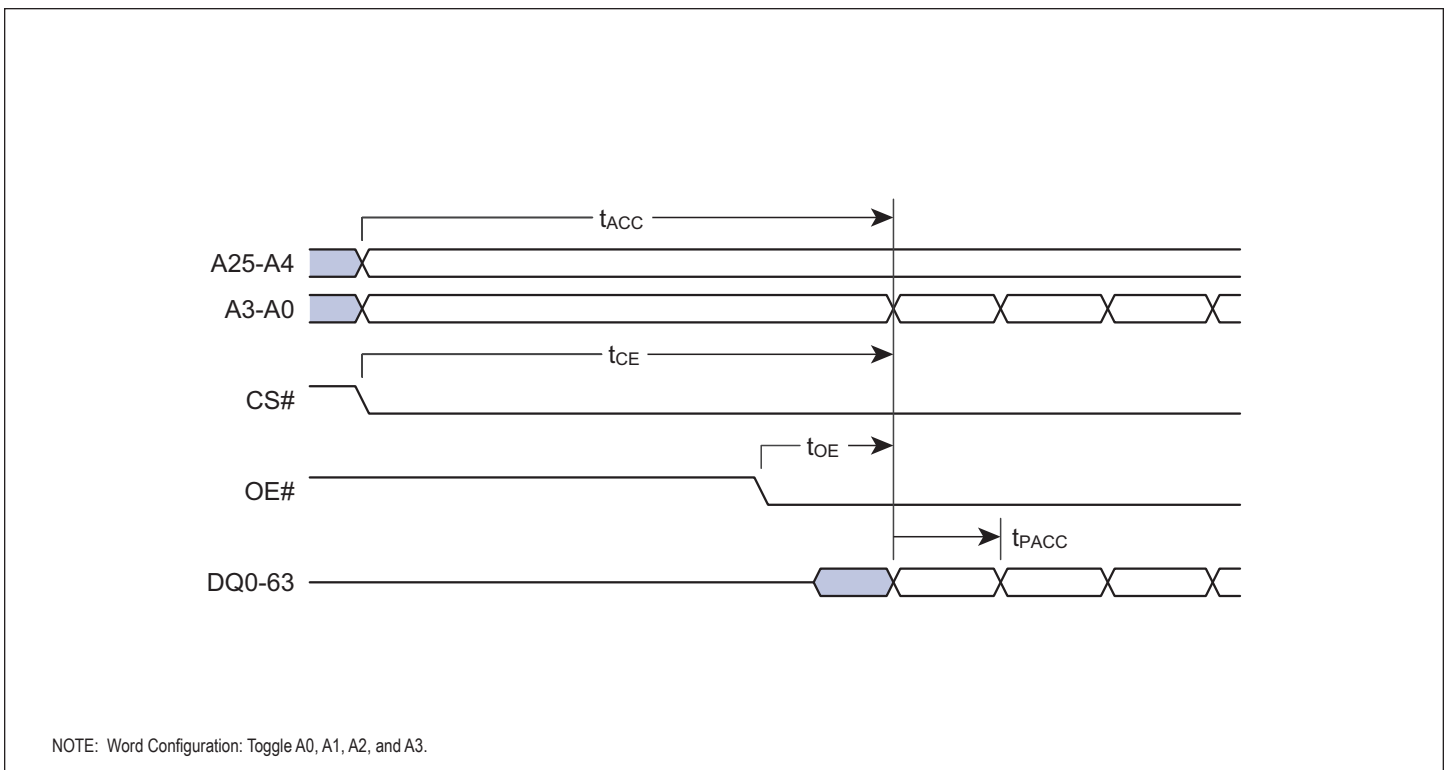
Parameter	Symbol		-110		-120		Unit
			Min	Max	Min	Max	
Read Cycle Time	t <sub>AVAV</sub>	t <sub>RC</sub>	110		120		ns
Address Access Time	t <sub>AVQV</sub>	t <sub>ACC</sub>		110		120	ns
Chip Select Access Time	t <sub>ELQV</sub>	t <sub>CE</sub>		110		120	ns
Page Access Time		t <sub>PACC</sub>		15		20	ns
Output Enable to Output Valid	t <sub>GLQV</sub>	t <sub>OE</sub>		25		25	ns
Chip Select High to Output High Z	t <sub>EHQZ</sub>	t <sub>DF</sub>		15		15	ns
Output Enable High to Output High Z	t <sub>GHQZ</sub>	t <sub>DF</sub>		15		15	ns
Output Hold from Addresses, CS# or OE# Change, Whichever occurs first	t <sub>AXQX</sub>	t <sub>OH</sub>	0		0		ns
Output Enable Hold Time (1)	Read	t <sub>OEH</sub>	0		0		ns
	Toggle and Data# Polling		10		10		ns

1. Guaranteed by design, not tested.

**FIGURE 4 – AC WAVEFORMS FOR READ OPERATIONS**



**FIGURE 5 – PAGE READ TIMING**

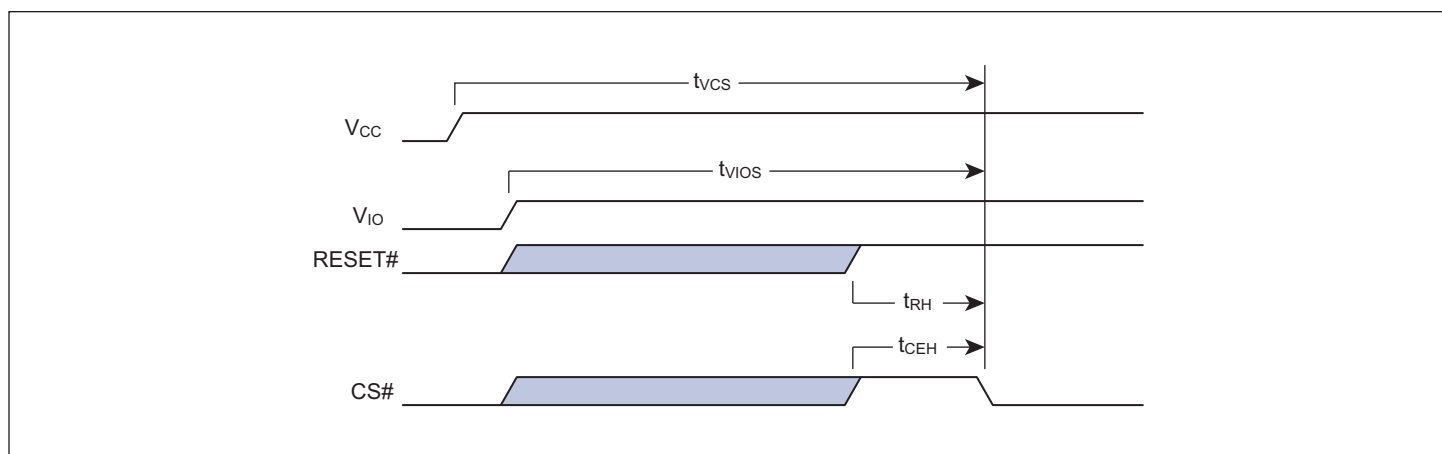
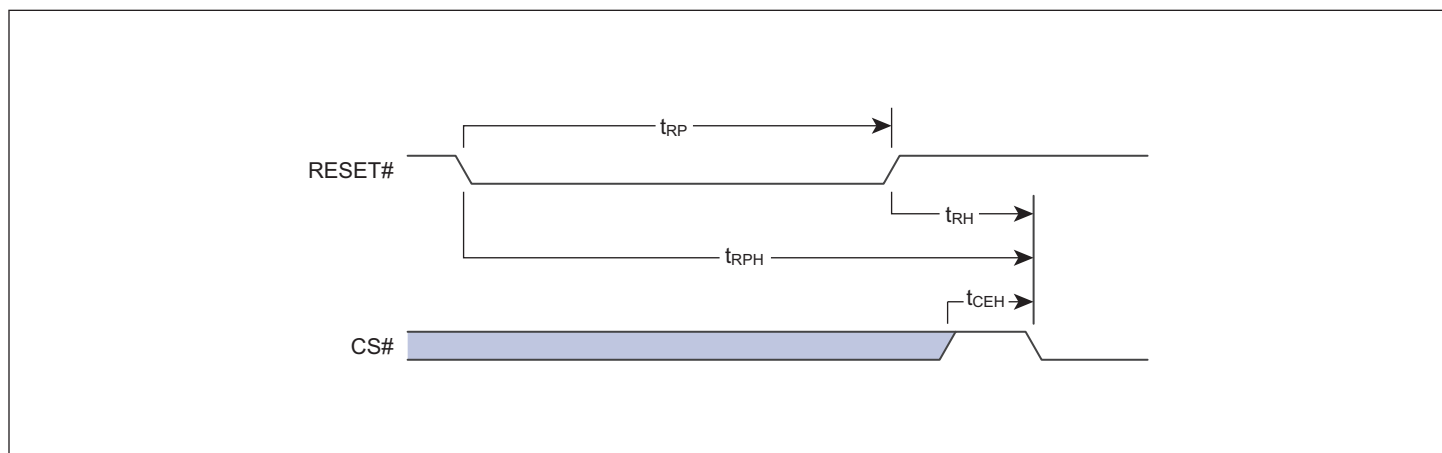


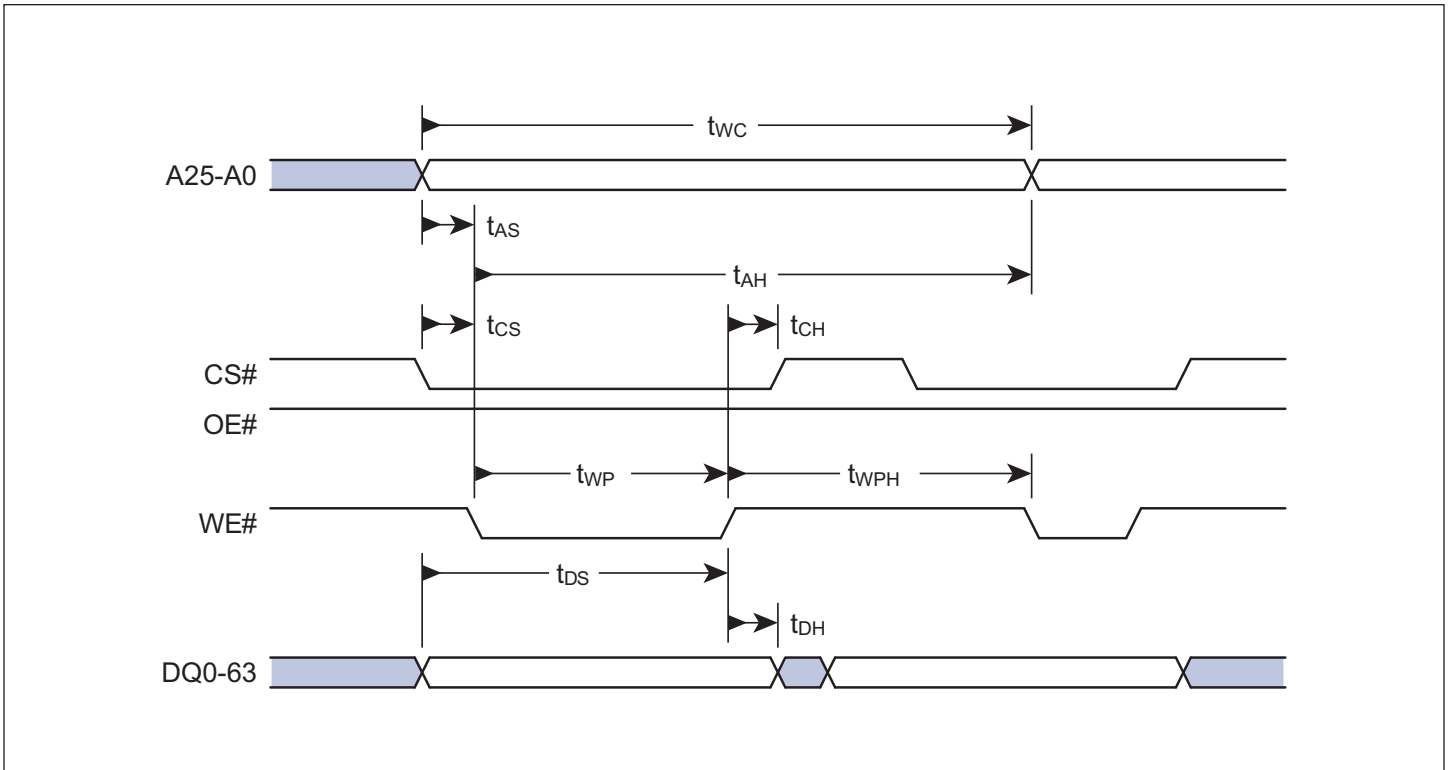
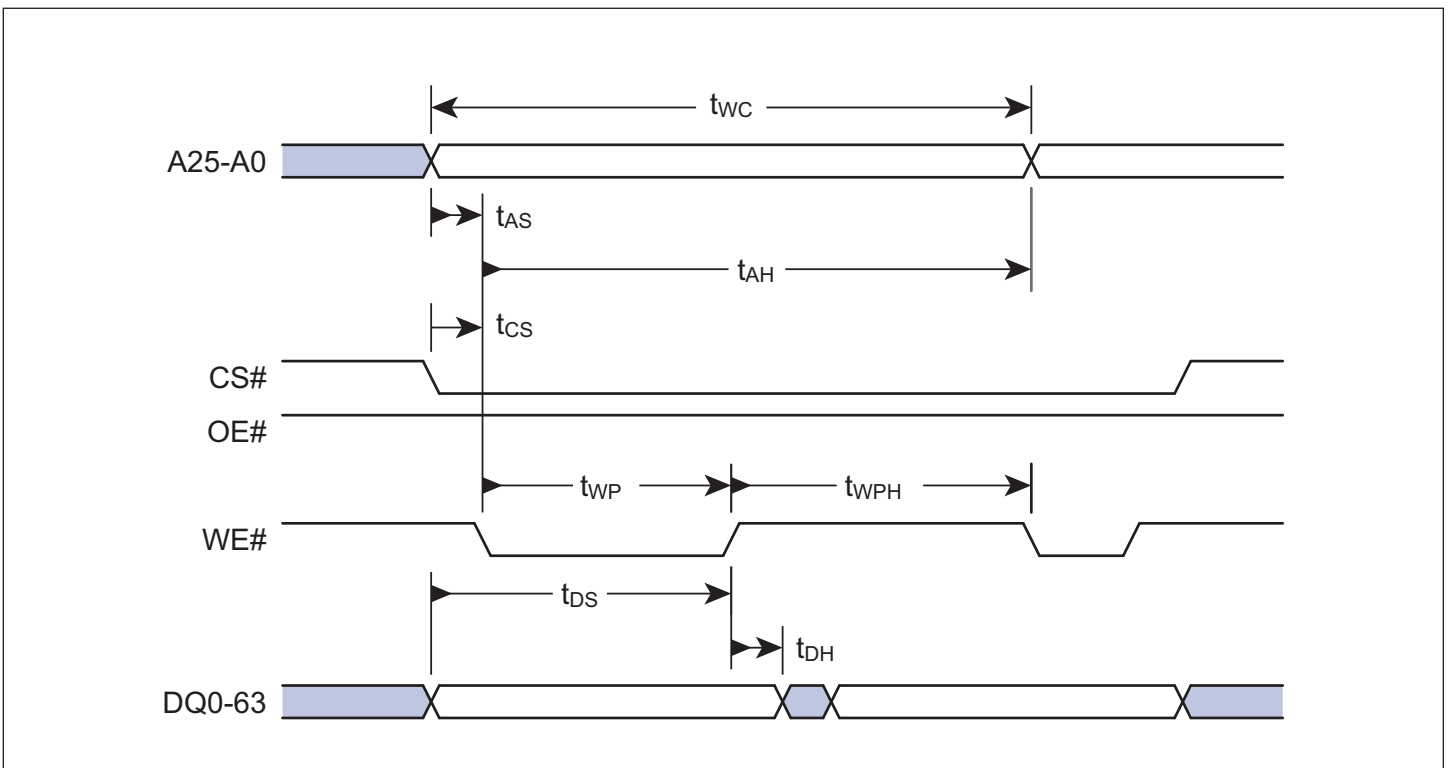
**POWER ON AND RESET PARAMETERS**

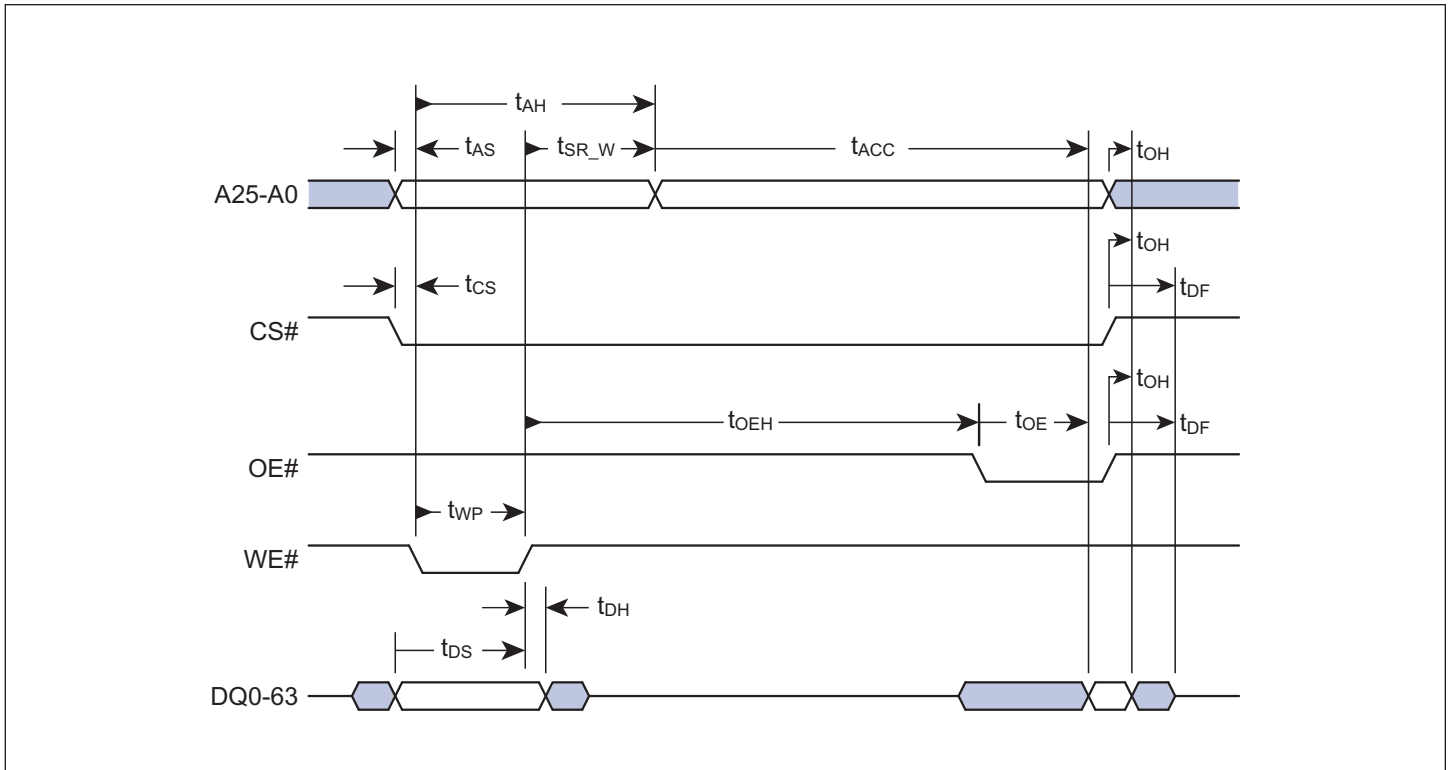
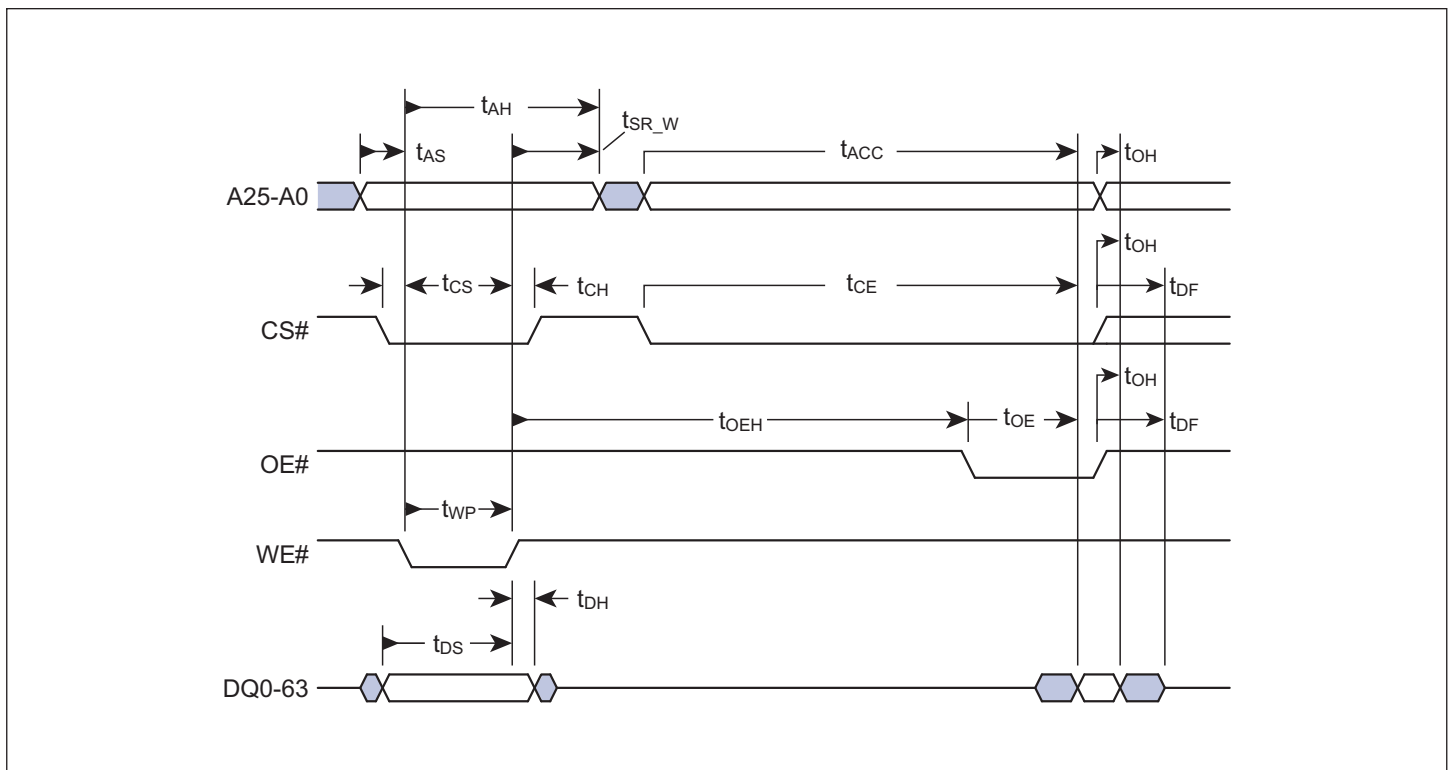
Parameter	Description	Limit	Value	Unit
$t_{VCS}$	$V_{CC}$ Setup Time to first access (1, 2)	Min	300	$\mu s$
$t_{VIO}$	$V_{IO}$ Setup Time to first access (1, 2)	Min	300	$\mu s$
$t_{RPH}$	RESET# Low to CS# Low (1, 2)	Min	35	$\mu s$
$t_{RP}$	RESET# Pulse Width	Min	200	ns
$t_{RH}$	Time between RESET# (High) and CS# (low) (1)	Min	50	ns
$t_{CEH}$	CS# Pulse Width High (1)	Min	20	ns

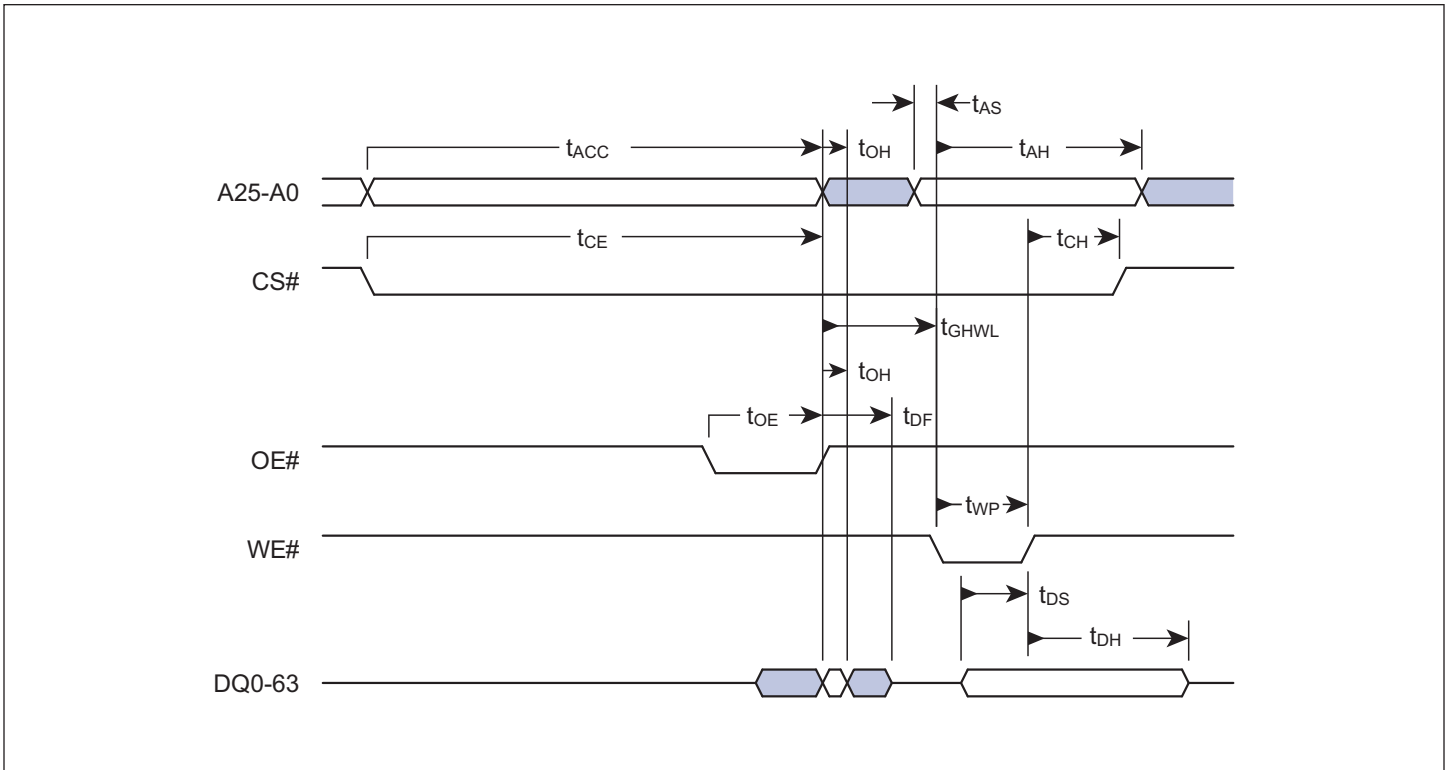
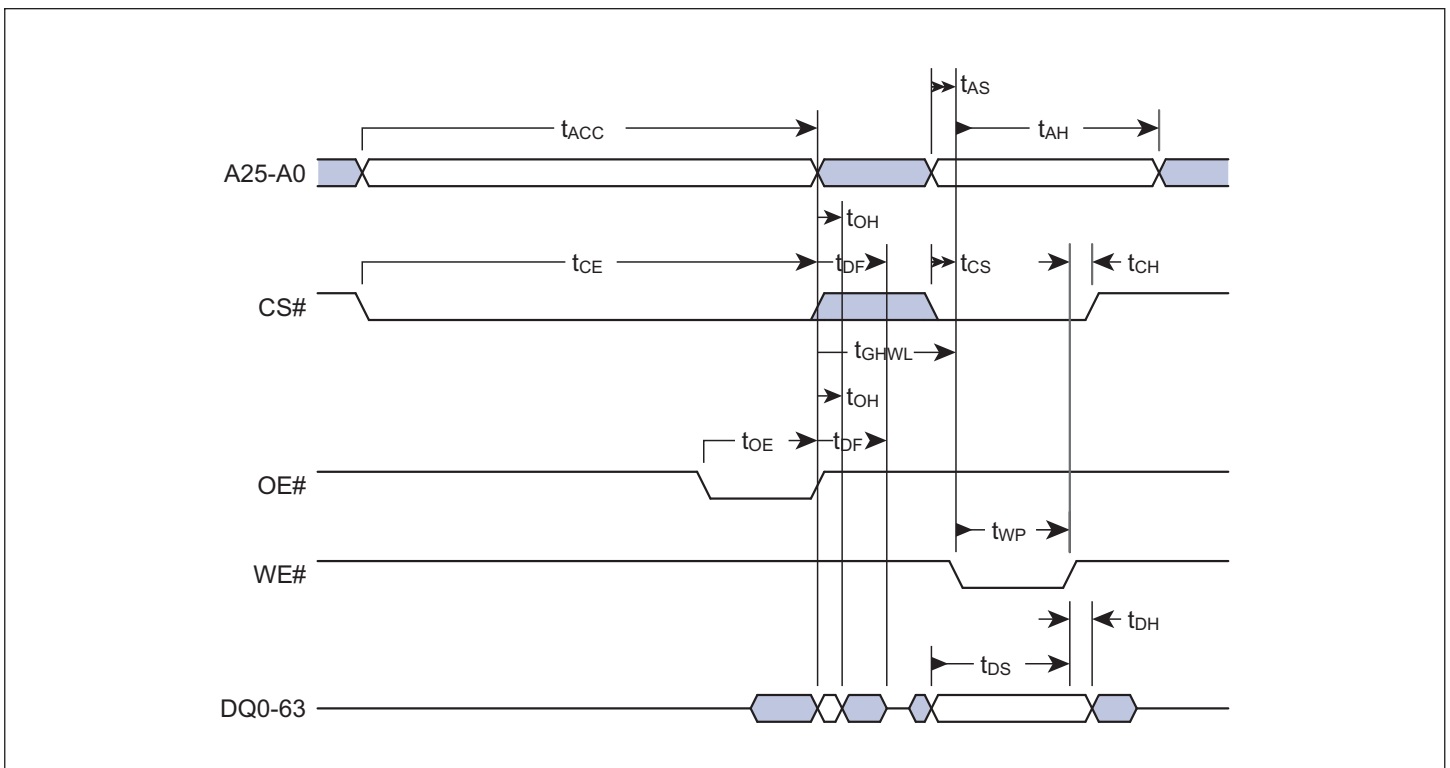
## NOTES:

1. Not tested.
2. Timing measured from  $V_{CC}$  reaching  $V_{CC}$  minimum and  $V_{IO}$  reaching  $V_{IO}$  minimum to  $V_{IH}$  on Reset and  $V_{IL}$  on CS#.
3. RESET# Low is optional during POR. If RESET is asserted during POR, the later of  $t_{RPH}$ ,  $t_{VIO}$ , or  $t_{VCS}$  will determine when CS# may go Low. If RESET# remains Low after  $t_{VIO}$ , or  $t_{VCS}$  is satisfied,  $t_{RPH}$  is measured from the end of  $t_{VIO}$ , or  $t_{VCS}$ . RESET must also be High  $t_{RH}$  before CS# goes Low.
4.  $V_{CC} \geq V_{IO} - 200$  mV during power-up.
5.  $V_{CC}$  and  $V_{IO}$  ramp rate can be non-linear.
6. Sum of  $t_{RP}$  and  $t_{RH}$  must be equal to or greater than  $t_{RPH}$ .

**FIGURE 6 – POWER-UP DIAGRAM**

**FIGURE 7 – HARDWARE RESET**


**FIGURE 8 – BACK TO BACK WRITE OPERATION TIMING DIAGRAM**

**FIGURE 9 – BACK TO BACK (CS#V<sub>IL</sub>) WRITE OPERATION TIMING DIAGRAM**


**FIGURE 10 – WRITE TO READ ( $t_{ACC}$ ) OPERATION TIMING DIAGRAM**

**FIGURE 11 – WRITE TO READ ( $t_{CE}$ ) OPERATION TIMING DIAGRAM**


**FIGURE 12 – READ TO WRITE (CS# V<sub>IL</sub>) OPERATION TIMING DIAGRAM**

**FIGURE 13 – READ TO WRITE (CS# TOGGLE) OPERATION TIMING DIAGRAM**


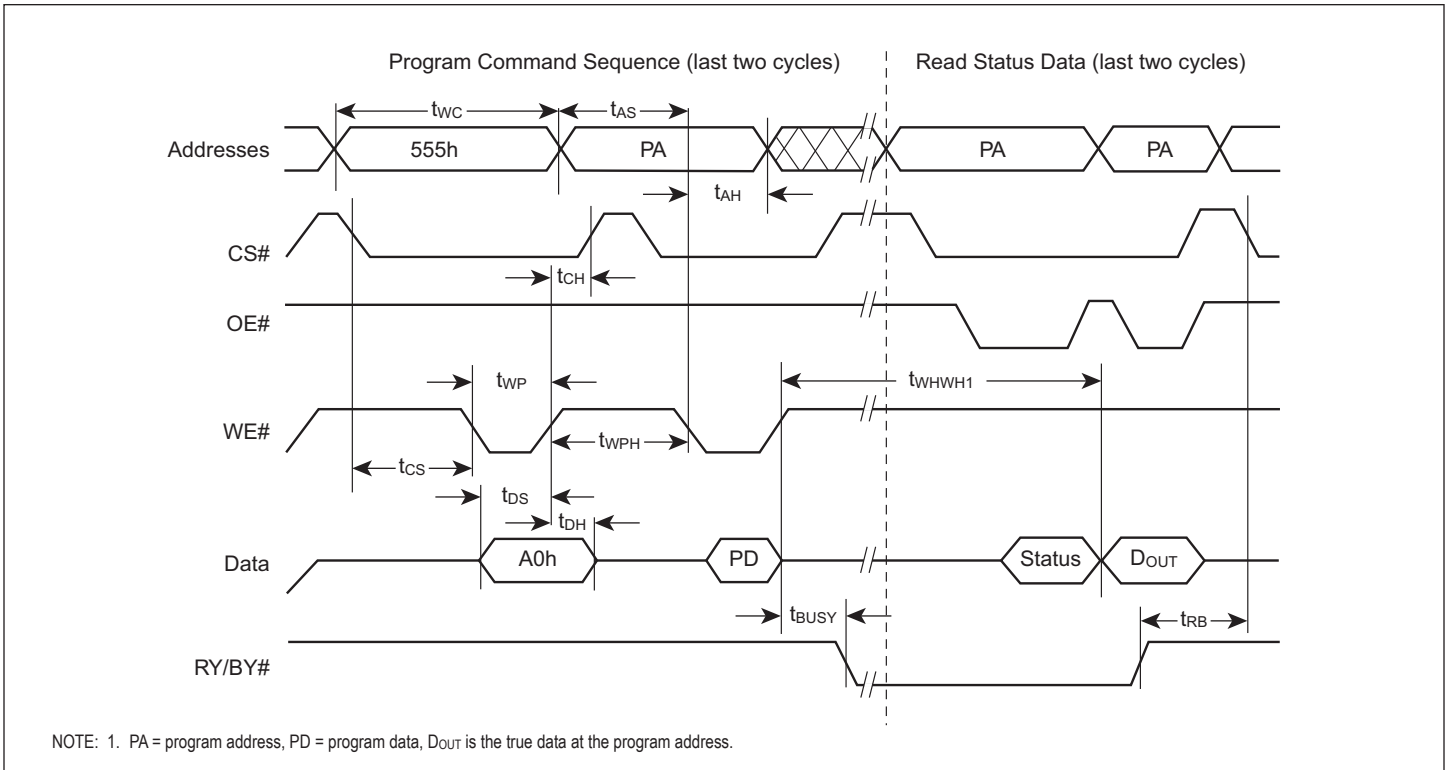
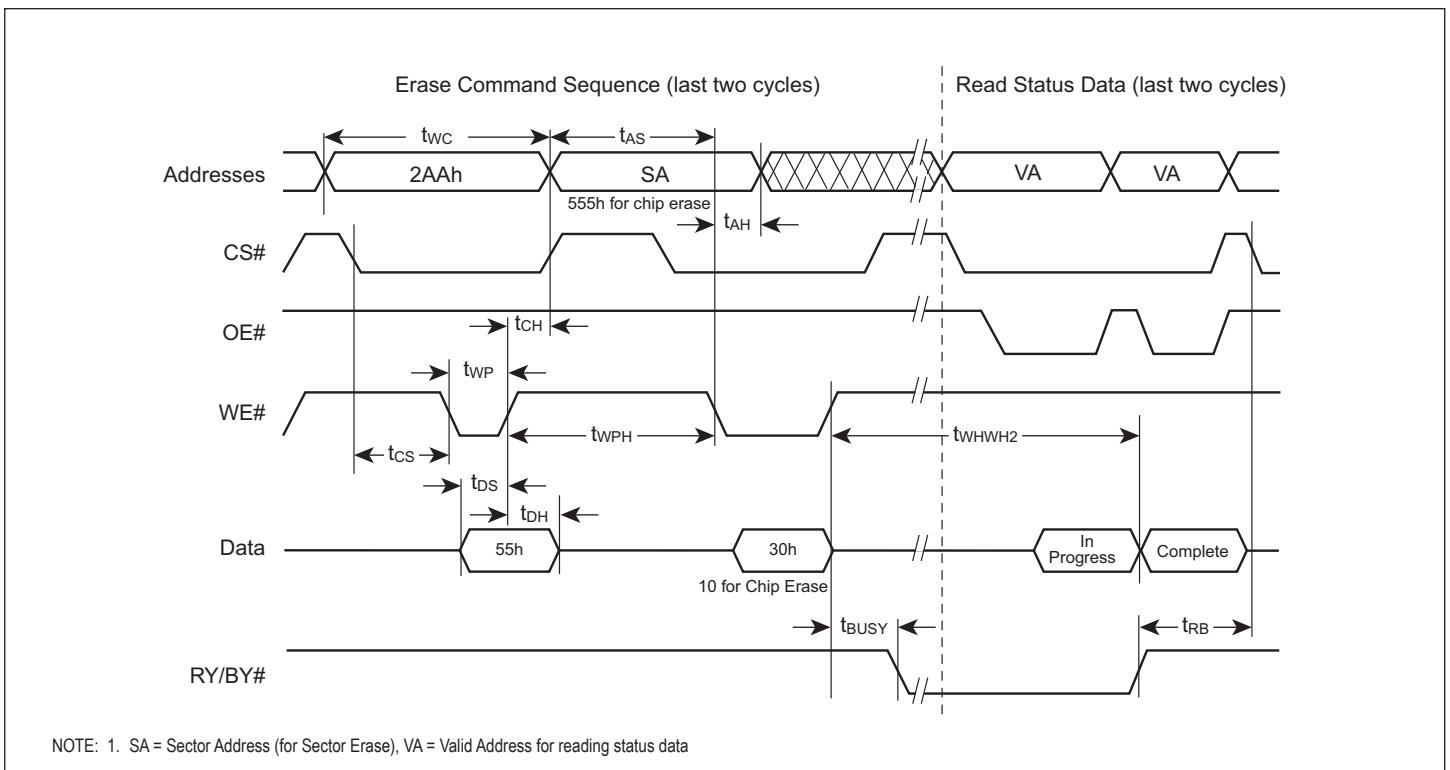
**FIGURE 14 – PROGRAM OPERATIONS**

**FIGURE 15 – CHIP/SECTOR ERASE OPERATION TIMINGS**




FIGURE 16 – DATA POLLING TIMINGS (DURING EMBEDDED ALGORITHMS)

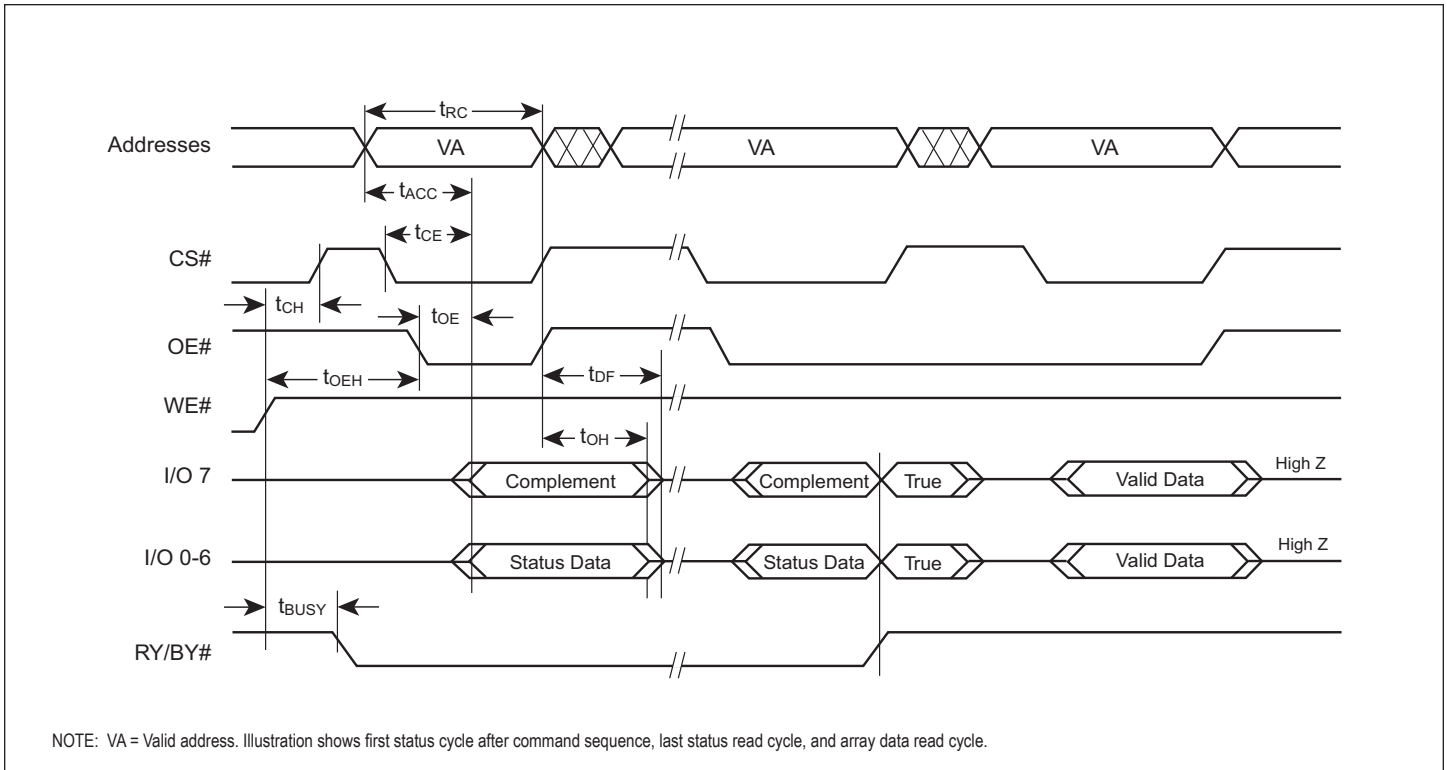
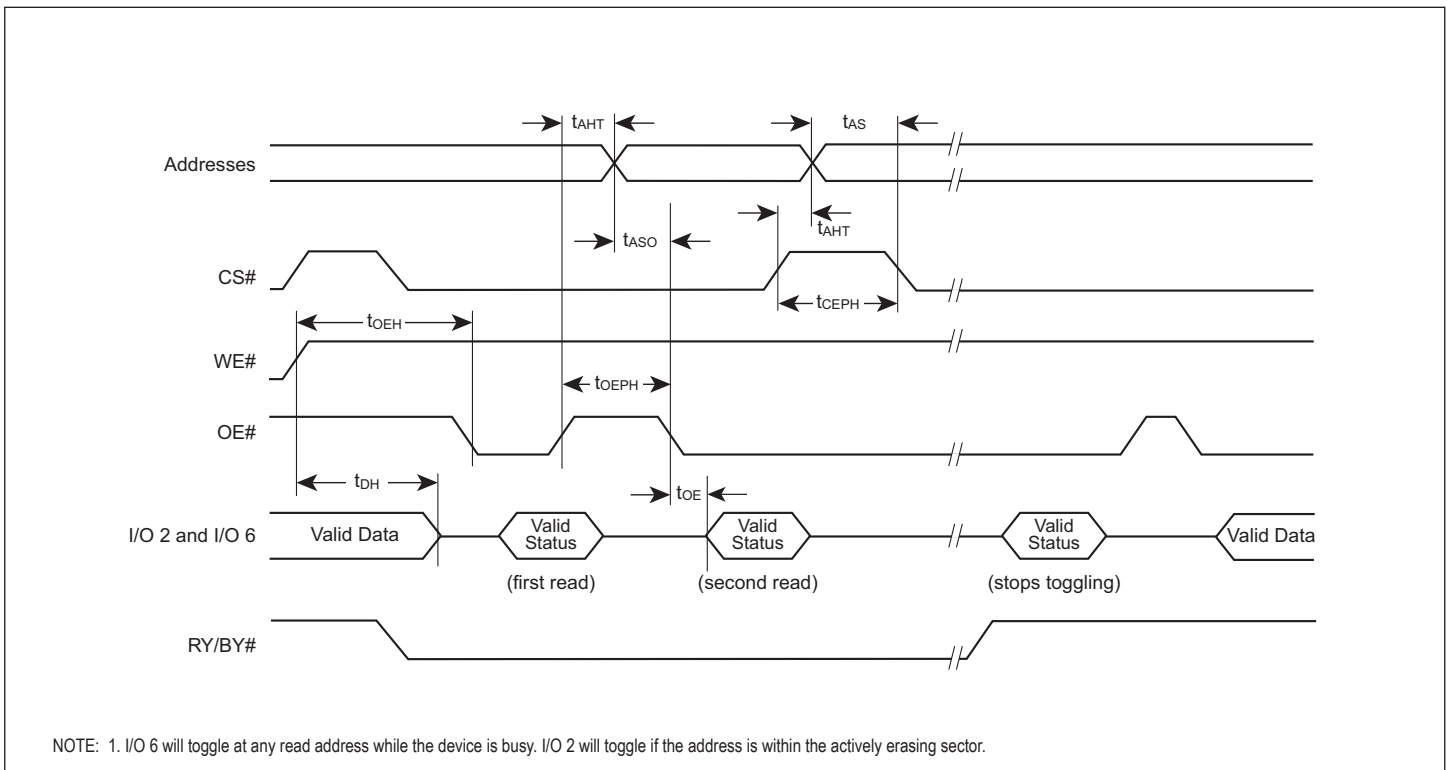
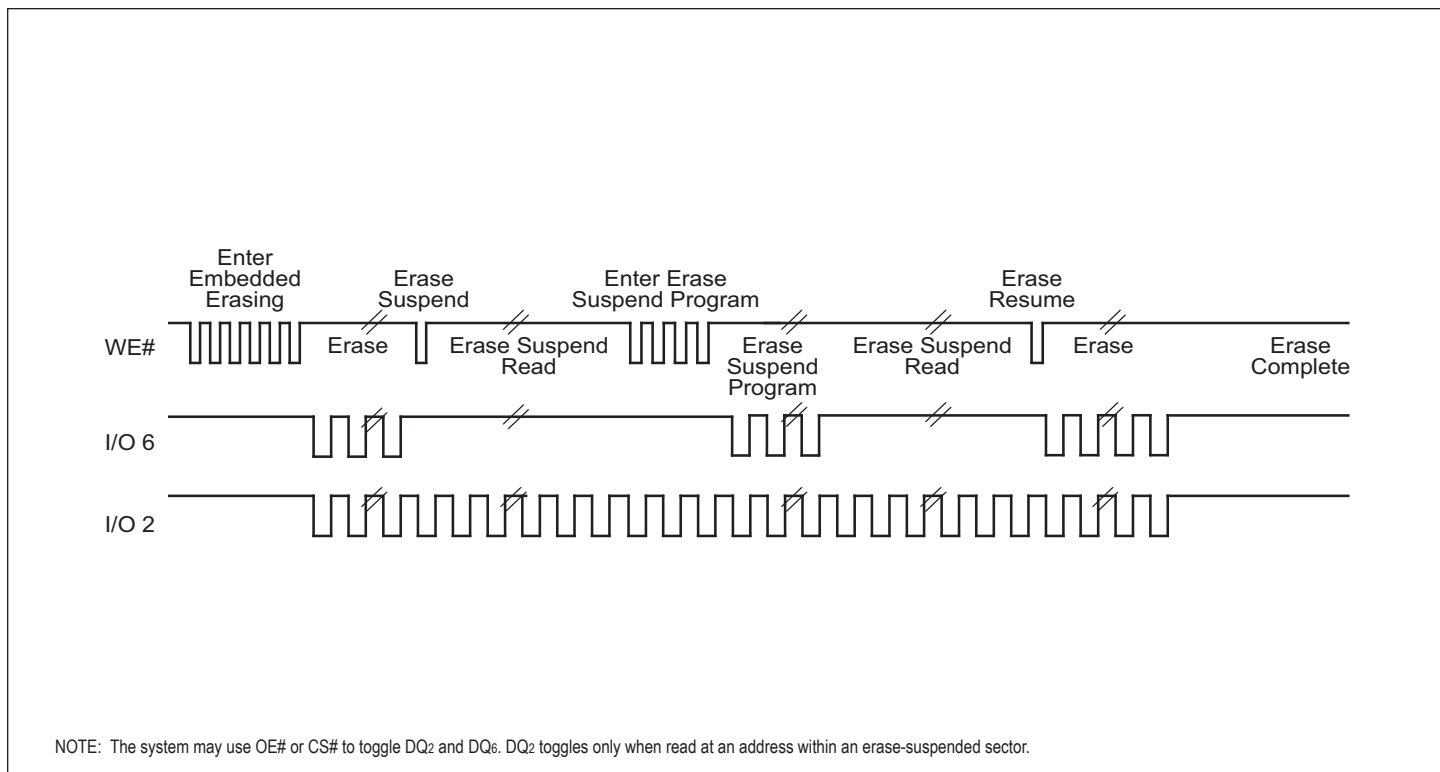


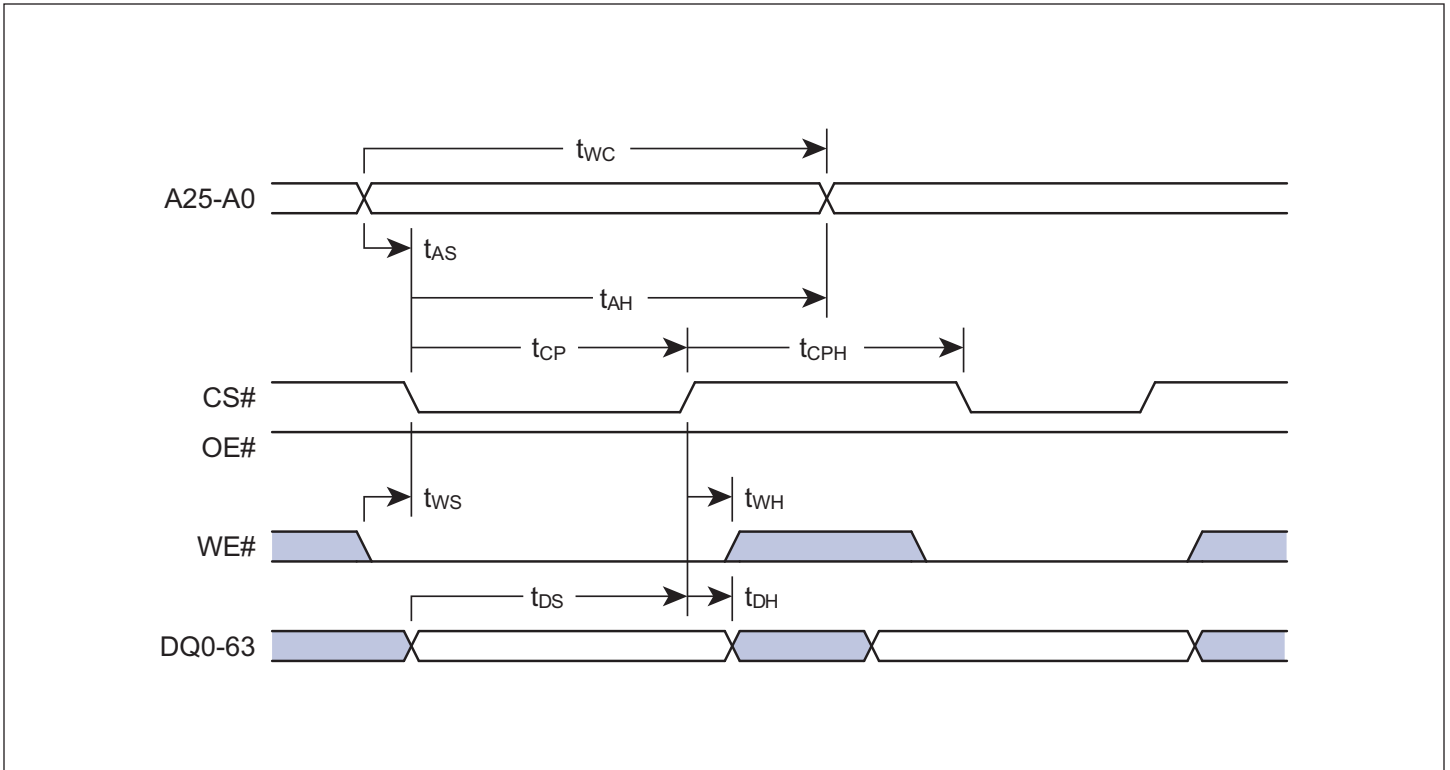
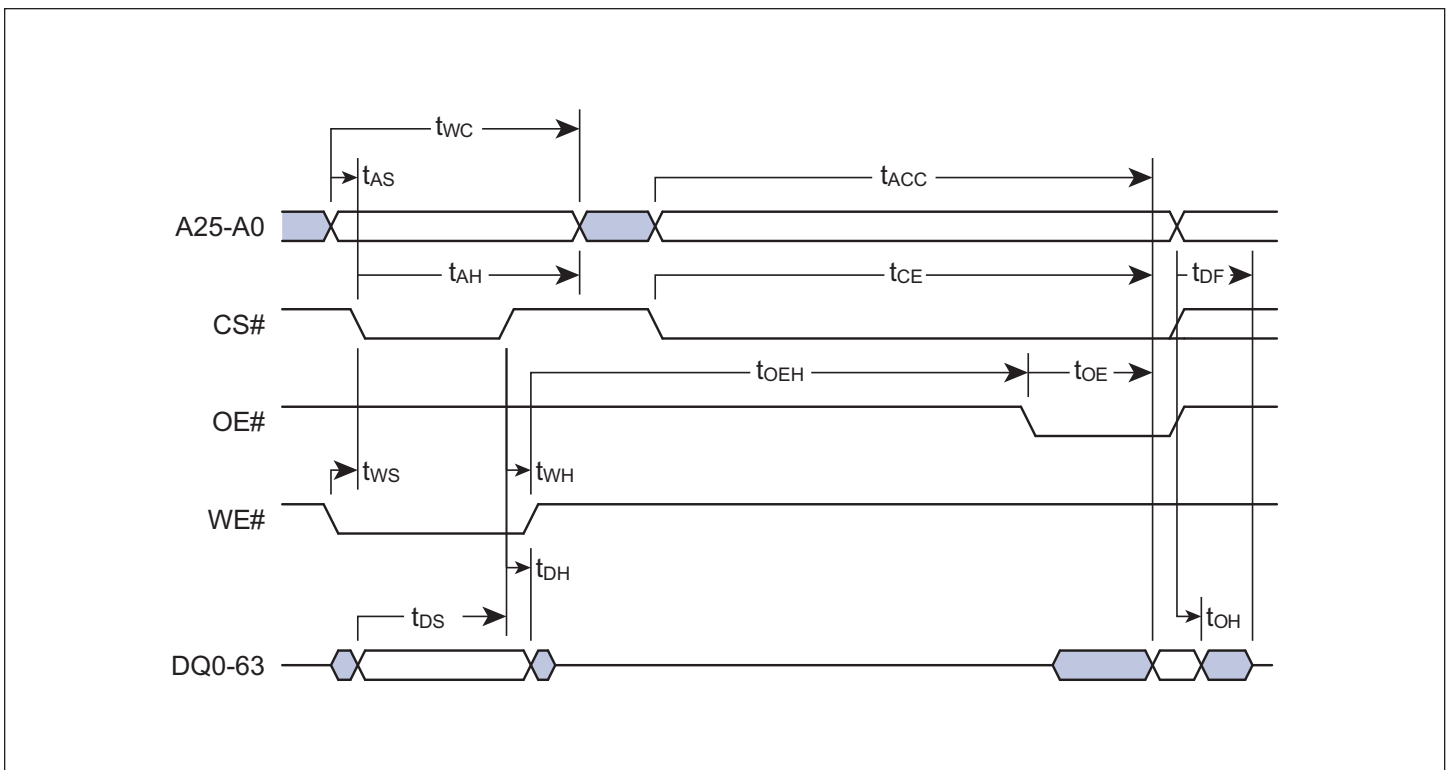
FIGURE 17 – TOGGLE BIT TIMINGS (DURING EMBEDDED ALGORITHMS)

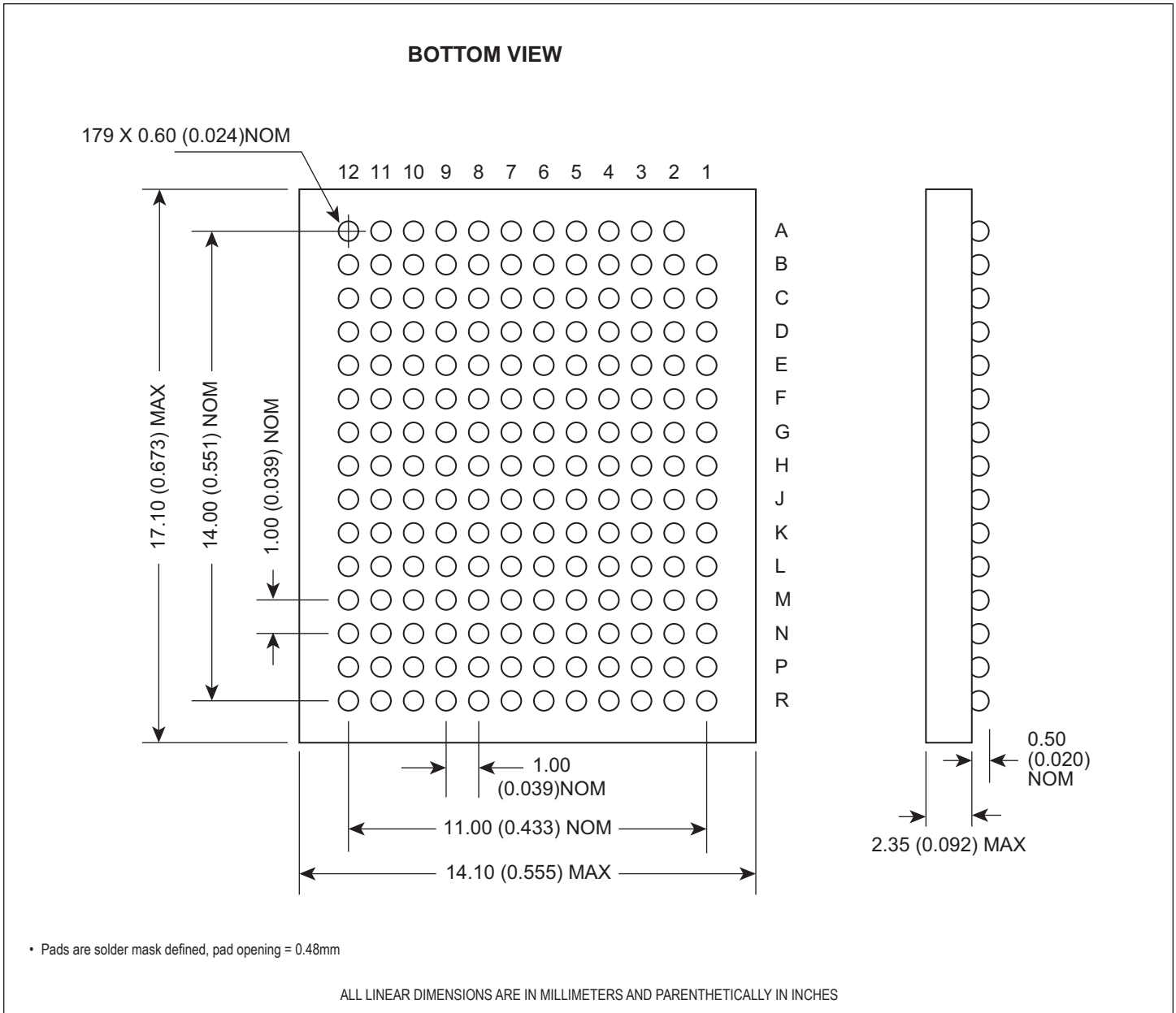


**FIGURE 18 – I/O 2 Vs. I/O 6**

**AC CHARACTERISTICS – ALTERNATE CS# CONTROLLED ERASE AND PROGRAM OPERATIONS**

Parameter		Description		Speed Options		Unit
JEDEC	Std			110	120	
t <sub>AVAV</sub>	t <sub>WC</sub>	Write Cycle Time	Min	60	60	ns
t <sub>AVWL</sub>	t <sub>AS</sub>	Address Setup Time	Min	0	0	ns
t <sub>ELAX</sub>	t <sub>AH</sub>	Address Hold Time	Min	45	45	ns
	t <sub>AHT</sub>	Address Hold Time From CS# or OE# High during toggle bit polling	Min	0	0	ns
t <sub>DVEH</sub>	t <sub>DS</sub>	Data Setup Time	Min	30	30	ns
t <sub>EHDX</sub>	t <sub>DH</sub>	Data Hold Time	Min	0	0	ns
	t <sub>CEPH</sub>	CS# High during toggle bit polling (1)	Min	20	20	ns
	t <sub>OEPH</sub>	OE# High during toggle bit polling (1)	Min	20	20	ns
t <sub>GHLEL</sub>	t <sub>GHLEL</sub>	Read Recovery Time Before Write (OE# High to WE# Low) (1)	Min	0	0	ns
t <sub>WLLEL</sub>	T <sub>WS</sub>	WE# Setup Time	Min	0	0	ns
t <sub>EHWH</sub>	t <sub>WH</sub>	WE# Hold Time	Min	0	0	ns
t <sub>ELEH</sub>	t <sub>CP</sub>	CS# Pulse Width	Min	25	25	ns
t <sub>EHEL</sub>	t <sub>CPH</sub>	CS# Pulse Width High	Min	20	20	ns
t <sub>WHWH1</sub>	t <sub>WHWH1</sub>	Buffer Programming Time	Typ	180	180	μs
t <sub>WHWH2</sub>	t <sub>WHWH2</sub>	Sector Erase Operation	Typ	0.3	0.3	sec

NOTE: 1. Not tested.

**FIGURE 19 – BACK TO BACK (CS#) WRITE OPERATION TIMING DIAGRAM**

**FIGURE 20 – (CS#) WRITE TO READ OPERATION TIMING DIAGRAM**


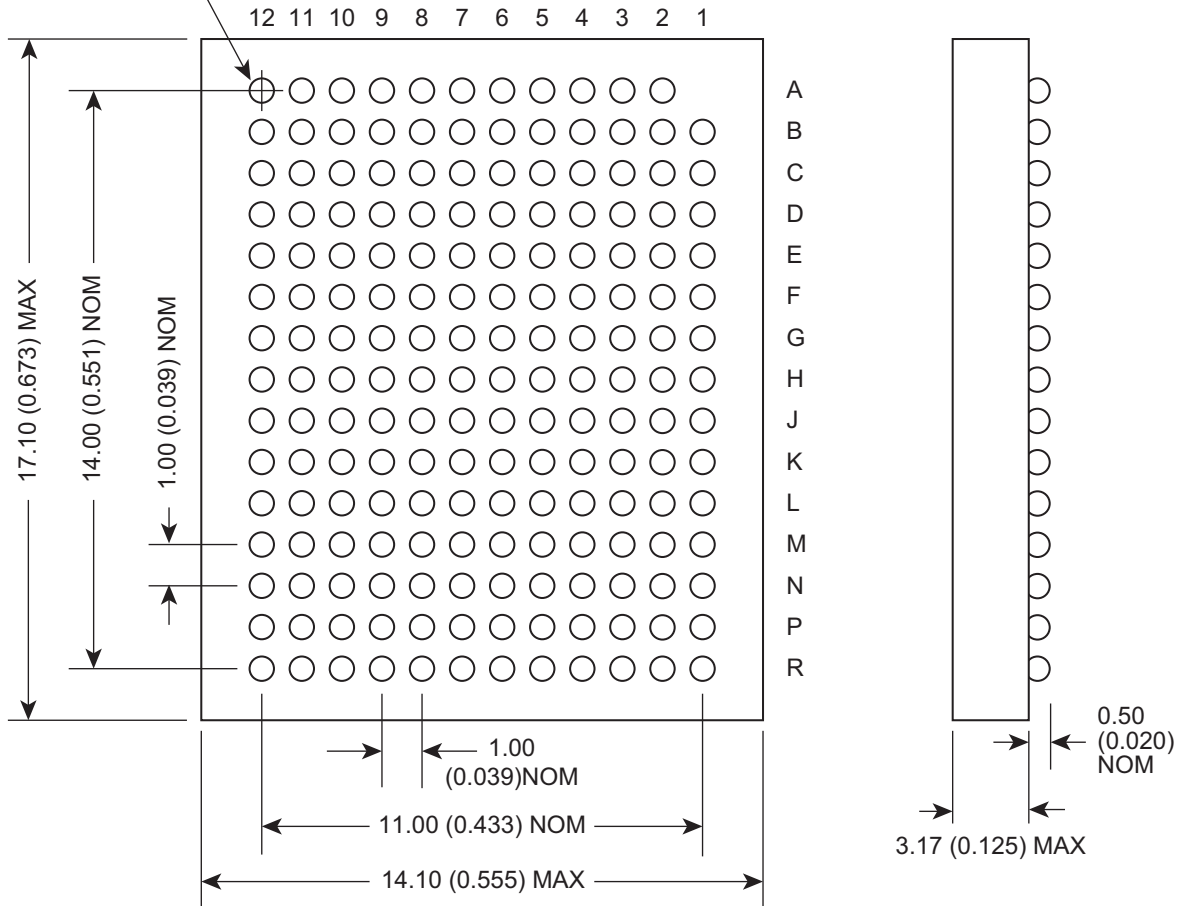
**W764M64V1-XBX (512MB) – 179 PBGA (PLASTIC BALL GRID ARRAY)**




## W7264M64V1-XBX (1GB) – 179 PBGA (PLASTIC BALL GRID ARRAY)

### BOTTOM VIEW

179 X 0.60 (0.024)NOM



• Pads are solder mask defined, pad opening = 0.48mm

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS AND PARENTHETICALLY IN INCHES



## ORDERING INFORMATION

W 7 X 64M64 V 1 - XXX B X

MICROSEMI CORPORATION

NOR FLASH

Rank

Blank = 1 rank of 64M x 64 (512MB)  
2 = 2 ranks of 64M x 64 (1GB)

ORGANIZATION, 64M x 64

3.3V POWER SUPPLY

1 = 1G Based Component

ACCESS TIME (ns)

110 = 110ns  
120 = 120ns  
ES = Non-qualified product <sup>1</sup>

PACKAGE TYPE

B = 179 PBGA, 14mm x 17mm

DEVICE GRADE

M = Military                    -55°C to +125°C  
I = Industrial                 -40°C to +85°C  
C = Commercial              0°C to +70°C  
Blank = No temperature range specified for non-qualified product

NOTE 1: W7X64M64V1-ESB is only available product until completion of qualification.

**Document Title**

512MB (64M x 64) / 1GB (2 x 64M x 64) NOR Flash Multi-Chip Package 3V Page Mode Memory

**Revision History**

<b>Rev #</b>	<b>History</b>	<b>Release Date</b>	<b>Status</b>
Rev 0	Initial Release	August 2014	Advanced
Rev 1	Changes (Pg. 1-20) 1.1 Change package 153 to 179 PBGA and updated package drawings 1.2 1GB package part number change 1.3 Added pin configuration	March 2015	Advanced