

# S71NSI28JA0/S71NS064JA0

**Stacked Multi-Chip Product (MCP)  
128 Megabit (8 M x 16-Bit) and 64 Megabit (4 M x 16-Bit),  
110 nm CMOS 1.8 Volt-only Simultaneous Read/Write,  
Burst Mode Flash Memories with 16 Megabit (1M x 16-Bit) pSRAM**



**PRELIMINARY**

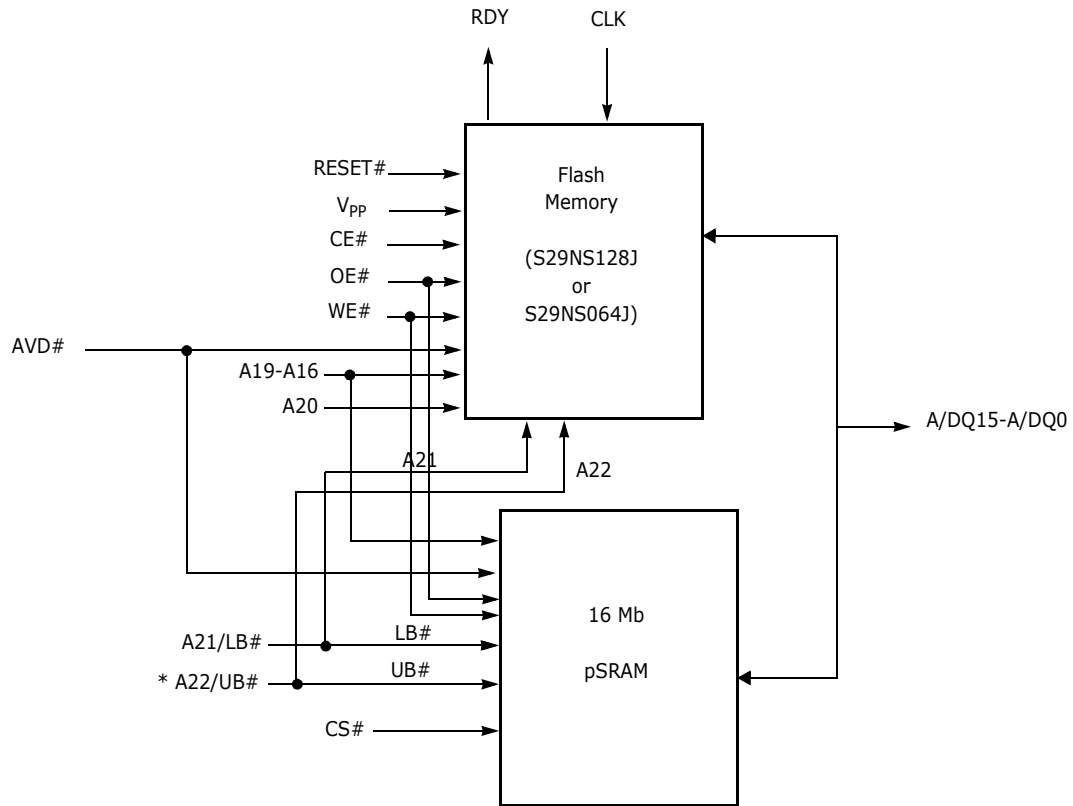
## Distinctive Characteristics

- **Single 1.8 volt read, program and erase (1.7 to 1.95 volt)**
- **Multiplexed Data and Address for reduced I/O count**
  - A15–A0 multiplexed as DQ15–DQ0
  - Addresses are latched by AVD# control input when CE# low
- **Simultaneous Read/Write operation**
  - Data can be continuously read from one bank while executing erase/program functions in other bank
  - Zero latency between read and write operations
- **Read access times at 66/54 MHz ( $C_L=30$  pF)**
  - Burst access times of 11/13.5 ns at industrial temperature range
  - Asynchronous random access times of 65/70 ns
  - Synchronous random access times of 71/87.5 ns
- **Burst length**
  - Continuous linear burst
  - 8/16/32 word linear burst with wrap around
  - 8/16/32 word linear burst without wrap around
- **Power dissipation (typical values, 8 bits switching,  $C_L = 30$  pF)**
  - Burst Mode Read: 25 mA
  - Simultaneous Operation: 40 mA
  - Program/Erase: 15 mA
  - Standby mode: 9  $\mu$ A
- **Sector Architecture**
  - Four 8 Kword sectors
  - Two hundred fifty-five (S29NS128J) or one hundred twenty-seven (S29NS064J) 32 Kword sectors
  - Four banks
- **Sector Protection**
  - Software command sector locking
  - All sectors locked when  $V_{PP} = V_{IL}$
- **Handshaking feature**
  - Provides host system with minimum possible latency by monitoring RDY
- **Supports Common Flash Memory Interface (CFI)**
- **Software command set compatible with JEDEC 42.4 standards**
  - Backwards compatible with Am29F and Am29LV families
- **Manufactured on 110 nm process technology**
- **Minimum 100,000 erase cycle guarantee per sector**
- **20-year data retention**
  - Reliable operation for the life of the system
- **Embedded Algorithms**
  - Embedded Erase algorithm automatically preprograms and erases the entire chip or any combination of designated sectors
  - Embedded Program algorithm automatically writes and verifies data at specified addresses
- **Data# Polling and toggle bits**
  - Provides a software method of detecting program and erase operation completion
- **Erase Suspend/Resume**
  - Suspends an erase operation to read data from, or program data to, a sector that is not being erased, then resumes the erase operation
- **Hardware reset input (RESET#)**
  - Hardware method to reset the device for reading array data
- **CMOS compatible inputs and outputs**
- **Package**
  - 48-ball Very Thin FBGA (S71NS128JA0)
  - 44-ball Very Thin FBGA (S71NS064JA0)

**PRODUCT SELECTOR GUIDE**

	<b>Part Number</b>	<b>S71NS128JA0, S71NS064JA0</b>	
	<b>MCP Model Number</b>	<b>00, 10, 20</b>	<b>01, 11, 21</b>
	<b>Burst Frequency</b>	<b>66 MHz</b>	<b>54 MHz</b>
<b>Flash Memory</b>	<b>Flash Memory Device/Model Number</b>	<b>S29NS128J/00, S29NS064J/00</b>	
	<b>Flash Speed Option</b>	<b>0P</b>	<b>0L</b>
	Max Initial Synchronous Access Time, ns ( $t_{IACC}$ )	71	87.5
	Max Burst Access Time, ns ( $t_{BACC}$ )	11	13.5
	Max Asynchronous Access Time, ns ( $t_{ACC}$ )	65	70
	Max CE# Access Time, ns ( $t_{CE}$ )		
	Max OE# Access Time, ns ( $t_{OE}$ )	11	13.5
<b>PSRAM</b>	Max Access Time, ns ( $t_{ACC2}$ )	90	90
	Max CE# Access Time, ns ( $t_{ACC3}$ )	90	90
	Max OE# Access Time, ns ( $t_{OE}$ )	50	50

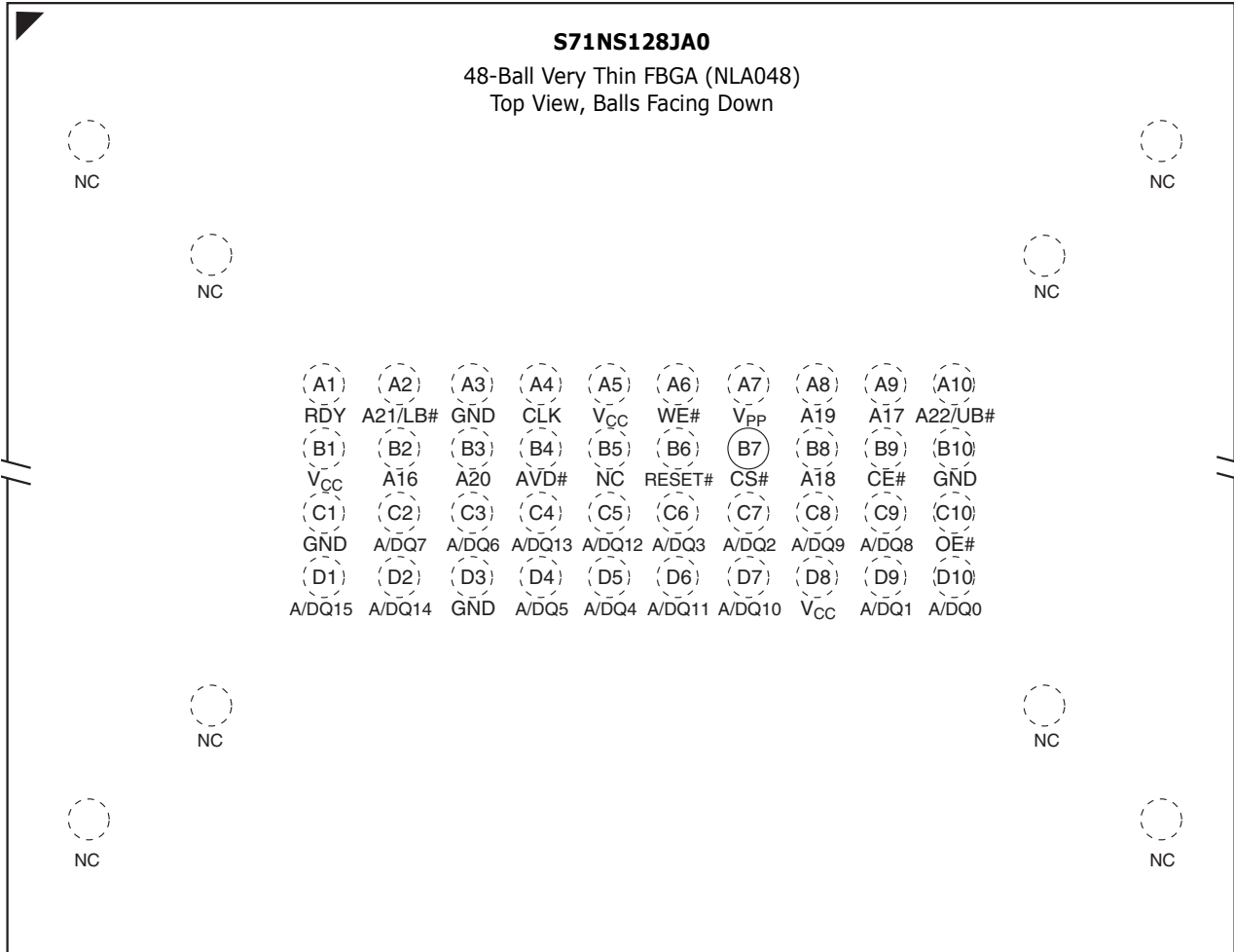
## MCP Block Diagram



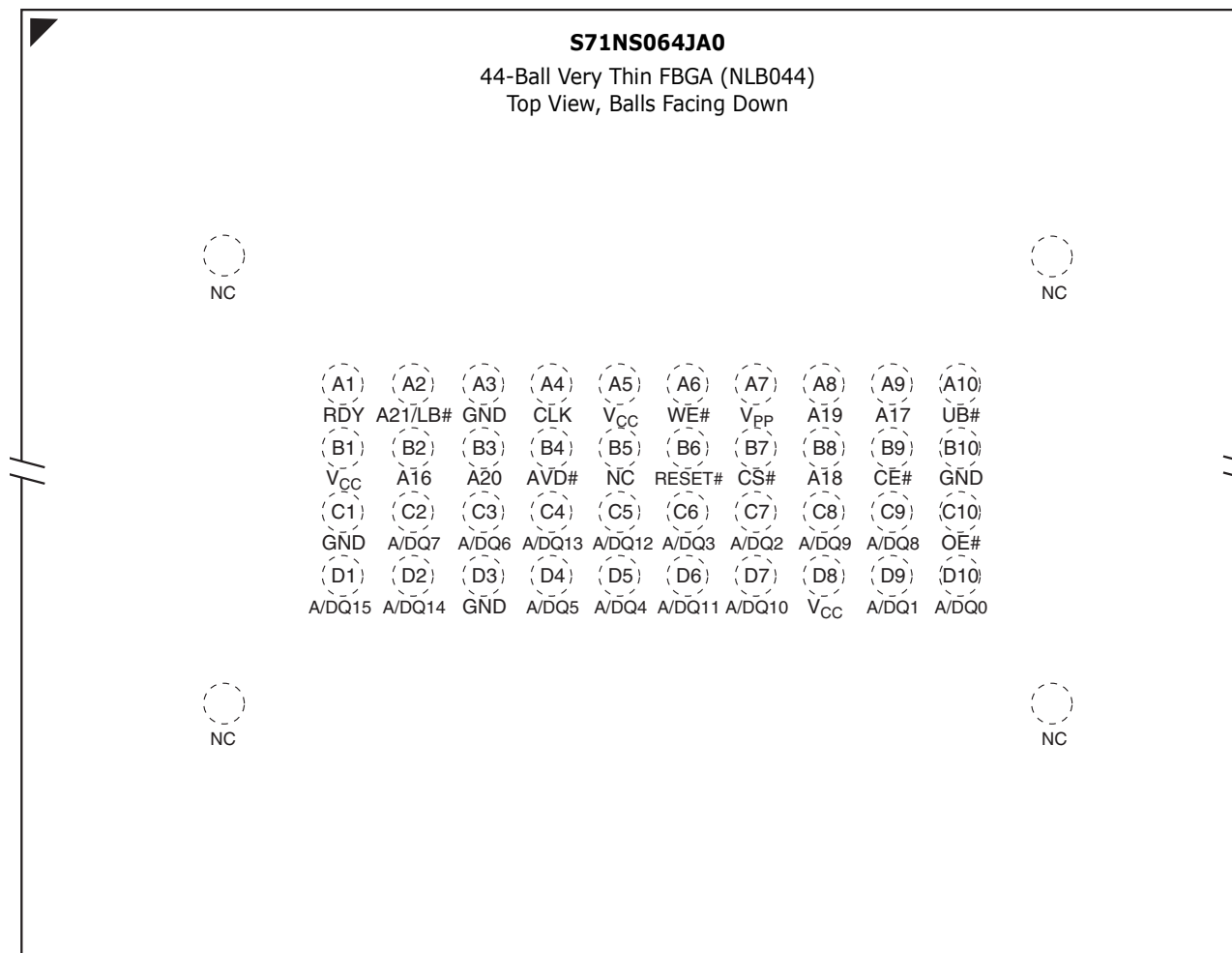
\* Note: A22 available for 128 Mb Flash only

1. A15–A0 are multiplexed with DQ15–DQ0.
2. A<sub>MAX</sub> indicates the highest order address bit.

### Connection Diagram



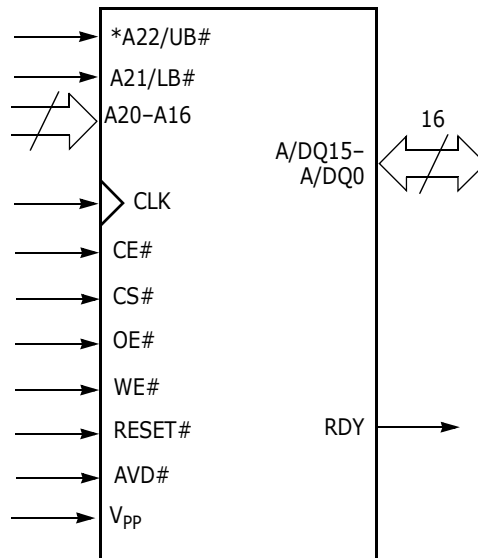
### CONNECTION DIAGRAM



## Input/Output Descriptions

A22/UB#	=	Address Inputs, pSRAM Upper Byte Control (A22 available for 128 Mb Flash)
A21/LB#	=	Address Inputs, pSRAM Lower Byte Control
A20-A16	=	Address Inputs
A/DQ15-A/DQ0	=	Multiplexed Address/Data input/output
CS#	=	pSRAM Chip Select Input
CE#	=	Flash Chip Enable Input. Asynchronous relative to CLK for the Burst mode.
OE#	=	Output Enable Input. Asynchronous relative to CLK for the Burst mode.
WE#	=	Write Enable Input.
V <sub>CC</sub>	=	Device Power Supply (1.7 V–1.95 V).
GND	=	Ground
NC	=	No Connect; not connected internally
RDY	=	Ready output; indicates the status of the Burst read. V <sub>OL</sub> = data invalid.
CLK	=	Flash Clock input. The first rising edge of CLK in conjunction with AVD# low latches address input and activates burst mode operation. After the initial word is output, subsequent rising edges of CLK increment the internal address counter. CLK should remain low during asynchronous access.
AVD#	=	Address Valid input. Indicates to device that the valid address is present on the address inputs (address bits A15–A0 are multiplexed, address bits A22–A16 are address only). V <sub>IL</sub> = for asynchronous mode, indicates valid address; for burst mode, causes starting address to be latched on rising edge of CLK. V <sub>IH</sub> = device ignores address inputs
RESET#	=	Hardware reset input. V <sub>IL</sub> = device resets and returns to reading array data
V <sub>PP</sub>	=	At 12 V, accelerates programming; automatically places device in unlock bypass mode. At V <sub>IL</sub> , disables program and erase functions. Should be at V <sub>IH</sub> for all other conditions.

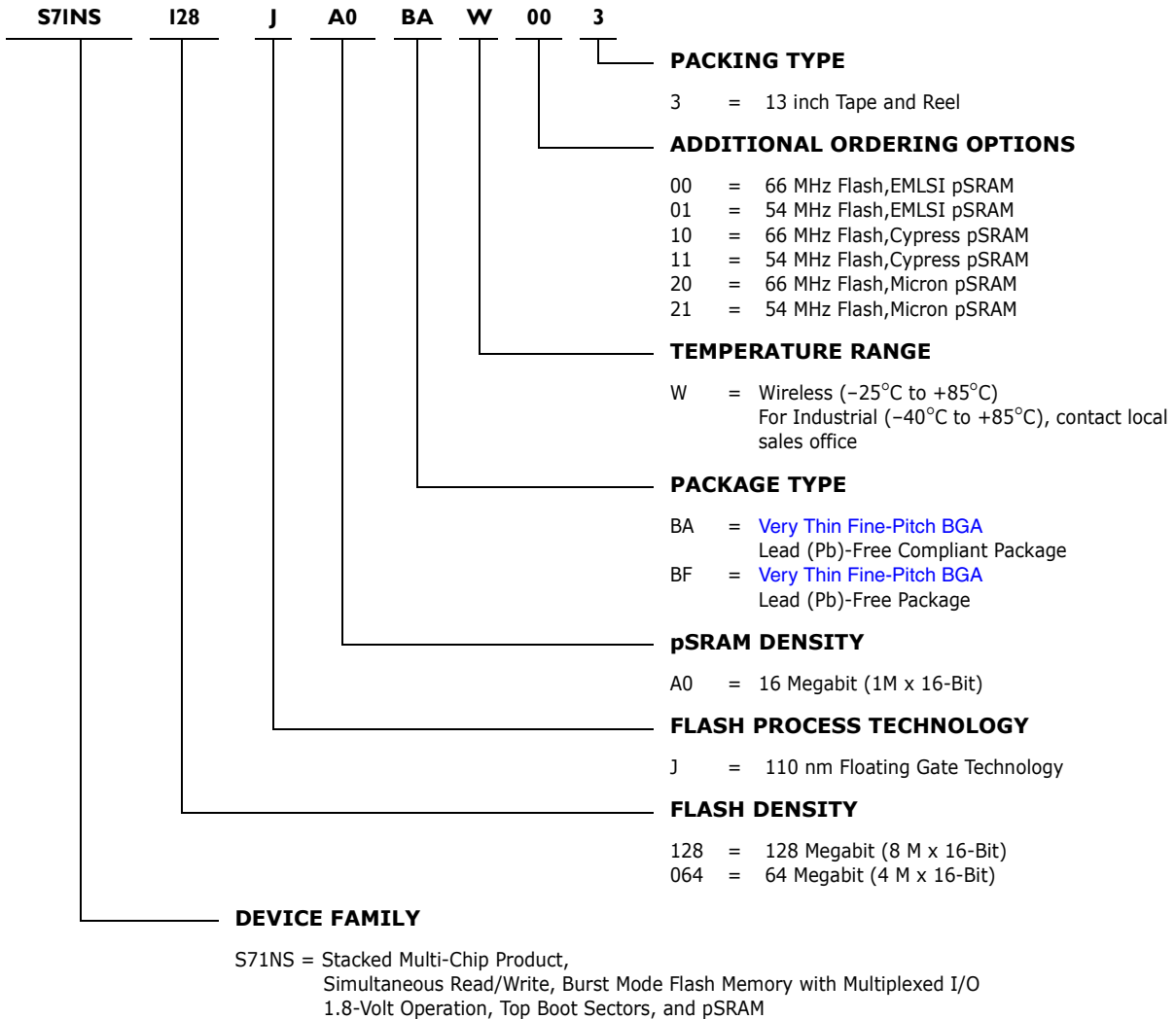
## Logic Symbol



\*A22 available for 128Mb Flash only.

## ORDERING INFORMATION

The order number (Valid Combination) is formed by the following:



### Valid Combinations

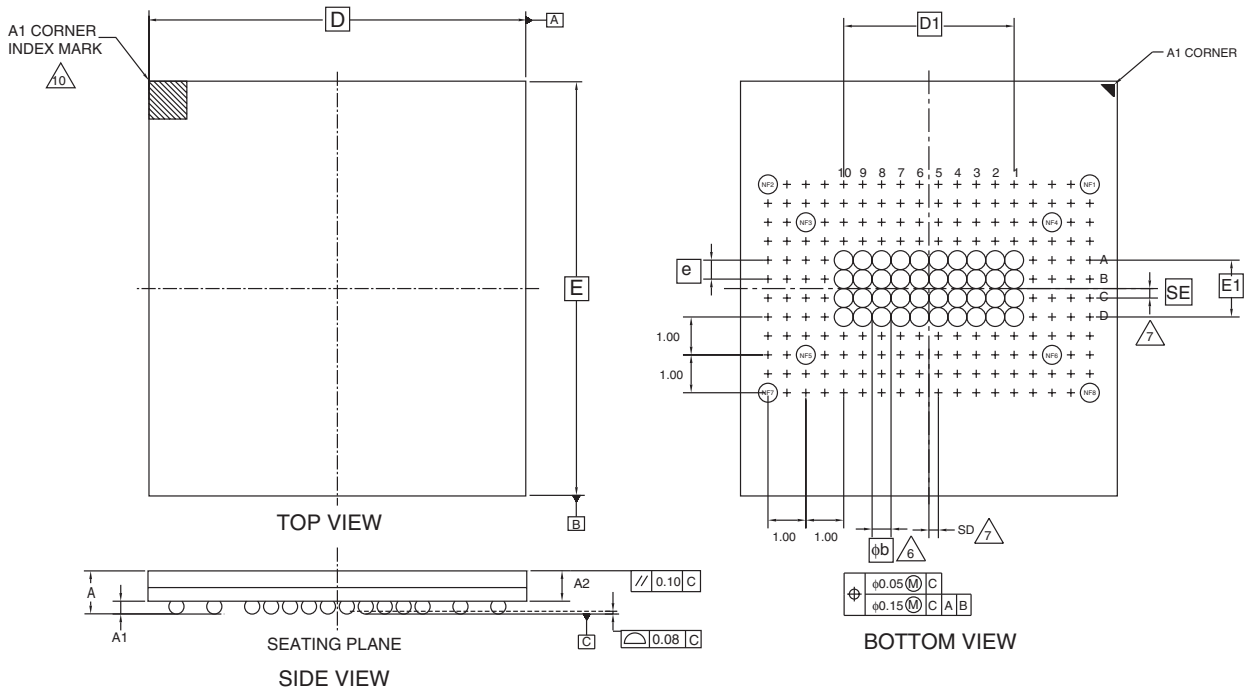
The following configurations are planned to be supported for this device. Consult the local sales office to confirm availability of specific valid combinations and to check on newly released combinations.

Valid Combinations for BGA Package				
Order Number	Package Marking	Package	Density	Speed
S71NS128JA0BAW013	71NS128JA0BAW01	Pb-Free Compliant	128 Mb + 16 Mb EMLSI pSRAM	54 MHz
S71NS128JA0BFW013	71NS128JA0BFW01	Pb-Free		
S71NS128JA0BAW113	71NS128JA0BAW11	Pb-Free Compliant	128 Mb + 16 Mb Cypress pSRAM	
S71NS128JA0BFW113	71NS128JA0BFW11	Pb-Free		
S71NS128JA0BAW213	71NS128JA0BAW21	Pb-Free Compliant	128 Mb + 16 Mb Micron pSRAM	
S71NS128JA0BFW213	71NS128JF0BAW21	Pb-Free		
S71NS064JA0BAW013	71NS064JA0BAW01	Pb-Free Compliant	64 Mb + 16 Mb EMLSI pSRAM	
S71NS064JA0BFW013	71NS064JA0BFW01	Pb-Free		
S71NS064JA0BAW113	71NS064JA0BAW11	Pb-Free Compliant	128 Mb + 16 Mb Cypress pSRAM	
S71NS064JA0BFW113	71NS064JA0BFW11	Pb-Free		
S71NS064JA0BAW213	71NS064JA0BAW21	Pb-Free Compliant	128 Mb + 16 Mb Micron pSRAM	
S71NS064JA0BFW213	71NS064JF0BAW21	Pb-Free		



# PHYSICAL DIMENSIONS—S71NS128JA0

## NLA048—48-Ball Very Thin Fine-Pitch Ball Grid Array (FBGA) 10 x 11 mm Package



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. BALL POSITION DESIGNATION PER JESD 95-1, SPP-010 (EXCEPT AS NOTED).
4.  $e$  REPRESENTS THE SOLDER BALL GRID PITCH.
5. SYMBOL "MD" IS THE BALL ROW MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL COLUMN MATRIX SIZE IN THE "E" DIRECTION.  
N IS THE TOTAL NUMBER OF SOLDER BALLS.
6. DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
7. SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.  
WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW PARALLEL TO THE D OR E DIMENSION, RESPECTIVELY, SD OR SE = 0.000.  
WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE =  $e/2$ .
8. NOT USED.
9. "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
10. A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

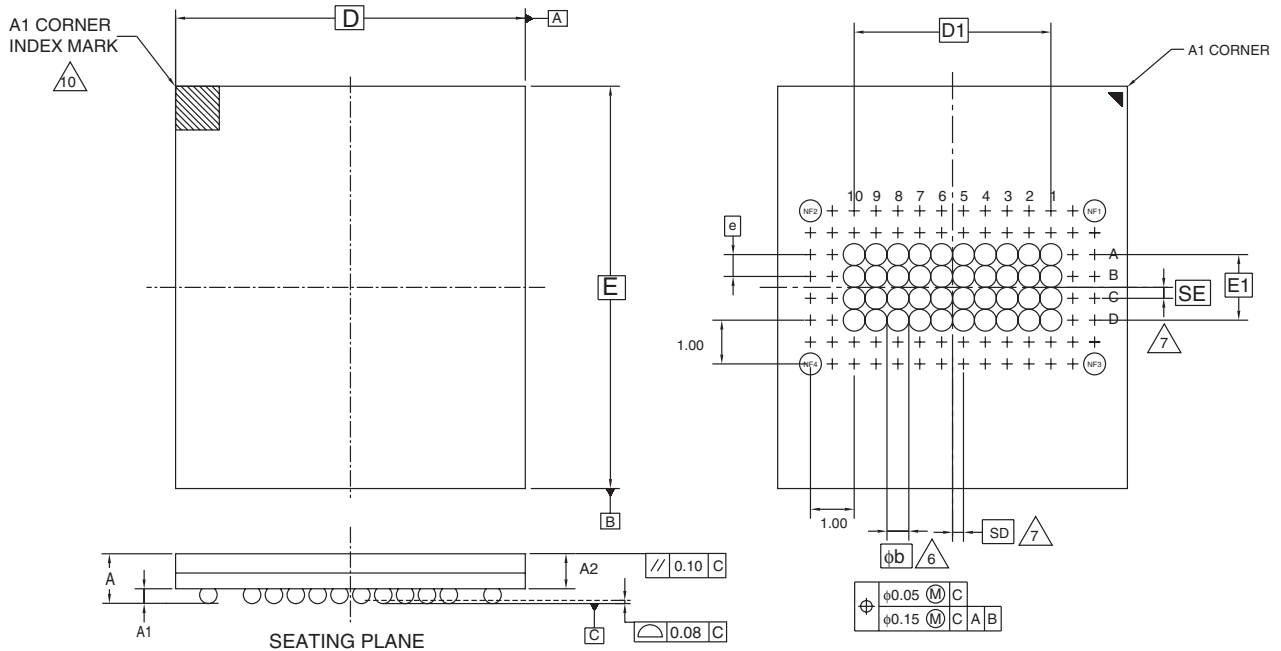
PACKAGE	NLA 048			NOTE
JEDEC	N/A			
	9.95 mm x 10.95 mm NOM PACKAGE			
SYMBOL	MIN	NOM	MAX	
A	1.05	---	1.20	OVERALL THICKNESS
A1	0.20	---	---	BALL HEIGHT
A2	0.85	0.91	0.97	BODY THICKNESS
D	9.85	9.95	10.05	BODY SIZE
E	10.85	10.95	11.05	BODY SIZE
D1	4.50 BSC.			BALL FOOTPRINT
E1	1.50 BSC.			BALL FOOTPRINT
MD	10			ROW MATRIX SIZE D DIRECTION
ME	4			ROW MATRIX SIZE E DIRECTION
N	48			TOTAL BALL COUNT
$\phi b$	0.25	0.30	0.35	BALL DIAMETER
e	0.50 BSC.			BALL PITCH
SD/SE	0.25 BSC.			SOLDER BALL PLACEMENT
	---			DEPOPULATED SOLDER BALLS

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\* For reference only. BSC is an ANSI standard for Basic Space Centering

# PHYSICAL DIMENSIONS—S71NS064JA0

## NLB044—44-Ball Very Thin Fine-Pitch Ball Grid Array (FBGA) 9.2 x 8 mm Package



PACKAGE	NLB 044			NOTE
JEDEC	N/A			
	8.00 mm x 9.20 mm NOM PACKAGE			
SYMBOL	MIN	NOM	MAX	
A	1.05	---	1.20	OVERALL THICKNESS
A1	0.20	---	---	BALL HEIGHT
A2	0.85	0.91	0.97	BODY THICKNESS
D	7.90	8.00	8.10	BODY SIZE
E	9.10	9.20	9.30	BODY SIZE
D1	4.50 BSC.			BALL FOOTPRINT
E1	1.50 BSC.			BALL FOOTPRINT
MD	10			ROW MATRIX SIZE D DIRECTION
ME	4			ROW MATRIX SIZE E DIRECTION
N	44			TOTAL BALL COUNT
φb	0.25	0.30	0.35	BALL DIAMETER
e	0.50 BSC.			BALL PITCH
SD/SE	0.25 BSC.			SOLDER BALL PLACEMENT
	---			DEPOPULATED SOLDER BALLS

NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- BALL POSITION DESIGNATION PER JESD 95-1, SPP-010 (EXCEPT AS NOTED).
- $e$  REPRESENTS THE SOLDER BALL GRID PITCH.
- SYMBOL "MD" IS THE BALL ROW MATRIX SIZE IN THE "D" DIRECTION.  
SYMBOL "ME" IS THE BALL COLUMN MATRIX SIZE IN THE "E" DIRECTION.  
N IS THE TOTAL NUMBER OF SOLDER BALLS.
- $\Delta 6$  DIMENSION "b" IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- $\Delta 7$  SD AND SE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER SOLDER BALL IN THE OUTER ROW.  
WHEN THERE IS AN ODD NUMBER OF SOLDER BALLS IN THE OUTER ROW PARALLEL TO THE D OR E DIMENSION, RESPECTIVELY, SD OR SE = 0.000.  
WHEN THERE IS AN EVEN NUMBER OF SOLDER BALLS IN THE OUTER ROW, SD OR SE =  $\frac{e}{2}$
- NOT USED.
- "+" INDICATES THE THEORETICAL CENTER OF DEPOPULATED BALLS.
- $\Delta 10$  A1 CORNER TO BE IDENTIFIED BY CHAMFER, LASER OR INK MARK, METALLIZED MARK INDENTATION OR OTHER MEANS.

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\* For reference only. BSC is an ANSI standard for Basic Space Centering

## Device History

Device/Model Number	Revision	Autoselect 0003h Contents	Major Reason(s) for Change
S71NS128JA0BA00	Initial (ES) EMLSI	712Eh	Initial release
S71NS128JA0BAW01	Initial (ES) EMLSI	711Eh	Initial release
S71NS0128JA0BFW01	Second (ES) EMLSI	711Dh	$t_{CSS}$ and $t_{AVDH}$ Timing Update
S71NS064JA0BAW21	Second (ES) Micron	711Dh	$t_{CSS}$ and $t_{AVDH}$ Timing Update
S71NS064JA0BFW21			

## APPENDIX A: DAISY CHAIN INFORMATION

**Table 1. Daisy Chain Part for 128/16Mbit Multi-Chip Products (NLA048, 10 x 11 mm)**

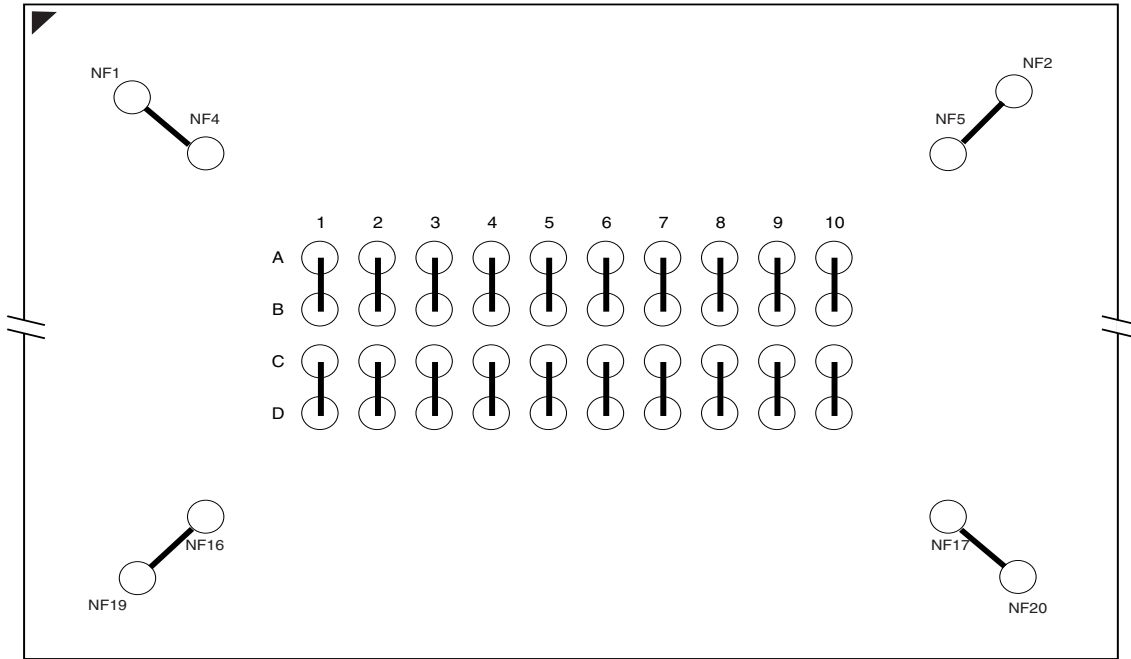
Daisy Chain Part Number	Package Marking	Daisy Chain Connection	Spansion 128/16Mb MCP Part Number	Flash Description
Lead (Pb) - Free Compliant: S99DCNLA048MSA002	99DCNLA048MSA00	Substrate	S71NS128JA0	128-Mbit 110nm Flash 16-Mbit pSRAM
Lead (Pb) - Free: S99DCNLA048MSF002	99DCNLA048MSF00			

**Table 2. NLA048 Package Information**

Component Type/Name	NLA048
Solder resist opening	0.25 ± 0.05 mm
Daisy Chain Connection Level	On Substrate
Lead-Free Compliant	Yes
Quantity per Reel	550 (300 units per reel by special request to factory)

**Table 3. NLA048 Connections**

C1-D1	C6-D6	A10-B10	A5-B5
C2-D2	C7-D7	A9-B9	A4-B4
C3-D3	C8-D8	A8-B8	A3-B3
C4-D4	C9-D9	A7-B7	A2-B2
C5-D5	C10-D10	A6-B6	A1-B1
<i>On substrate</i>			
NF1-NF4		NF2-NF5	
NF16-NF19		NF17-NF20	



**Figure I. NLA048 Daisy Chain Layout  
(Top View, Balls Facing Down)**

## APPENDIX B: DAISY CHAIN INFORMATION

**Table 4. Daisy Chain Part for 64/16Mbit Multi-Chip Products (NLB044, 9.2 x 8 mm)**

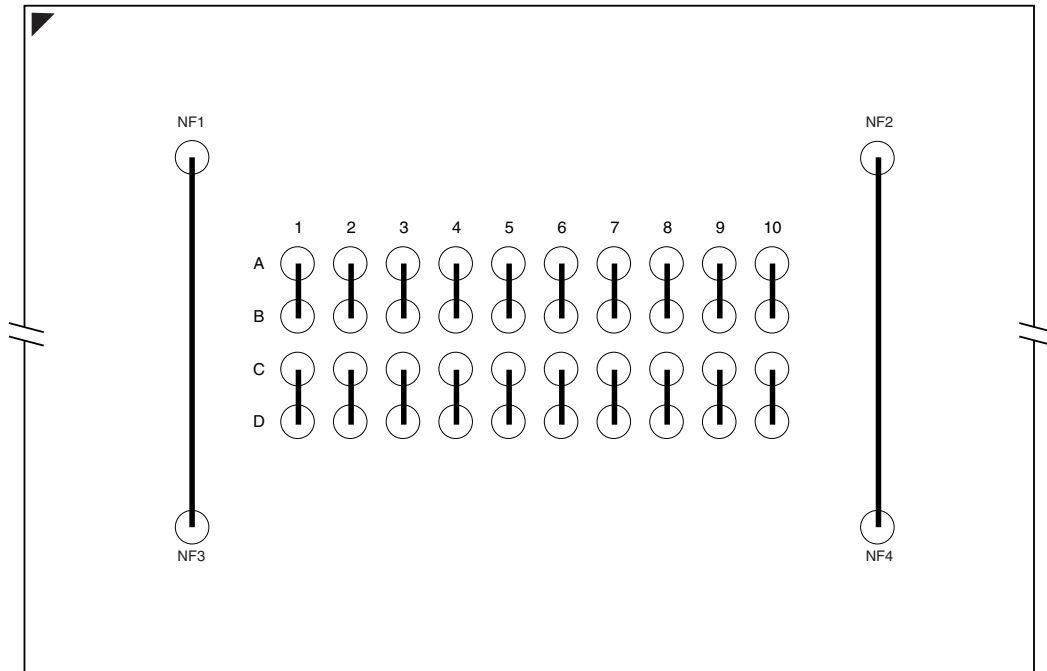
Daisy Chain Part Number	Package Marking	Daisy Chain Connection	Spansion 64/16Mb MCP Part Number	Description
Lead (Pb) - Free Compliant: S99DCNLB044MSA002	99DCNLB044MSA00	Substrate Level	S71NS064JA0	64-Mbit 110nm Flash 16-Mbit pSRAM
Lead (Pb)- Free: S99DCNLB044MSF002	99DCNLB044MSF00			

**Table 5. NLB044 Package Information**

Component Type/Name	NLB044
Solder resist opening	0.25 ± 0.05 mm
Daisy Chain Connection Level	On Substrate
Lead-Free Compliant	Yes
Quantity per Reel	600 (300 units per reel by special request to factory)

**Table 6. NLB044 Connections**

C1-D1	C6-D6	A10-B10	A5-B5
C2-D2	C7-D7	A9-B9	A4-B4
C3-D3	C8-D8	A8-B8	A3-B3
C4-D4	C9-D9	A7-B7	A2-B2
C5-D5	C10-D10	A6-B6	A1-B1
<i>On substrate</i>			
NF1-NF3		NF2-NF4	



**Figure 2. NLB044 Daisy Chain Layout  
(Top View, Balls Facing Down)**

## pSRAM CHARACTERISTICS

### pSRAM Device Bus Operations

CS#	OE#	WE#	LB#	UB#	AVD#	A[19-16]	A/DQ[15-0]	Mode	Power
H	X	X	X	X	X	X	HIGH-Z	Deselected	Standby
L	H	H	X	X	H	X	HIGH-Z	Output Disabled	Active
L	X	X	H	H	X	X	HIGH-Z	Output Disabled	Active
L	H	L	H	H	H	X	Data In	Configuration Register Write Access	Active
L	L	H	H	H	H	X	Data Out	Configuration Register Read Access	Active
L	H	H	H	H	L	Addr In	Addr In	Address Input	Active
L	L	H	L	H	H	X	Data Out	Lower Byte Read	Active
L	L	H	H	L	H	X	Data Out	Upper Byte Read	Active
L	L	H	L	L	H	X	Data Out	Word Read	Active
L	H	L	L	H	H	X	Data In	Lower Byte Write	Active
L	H	L	H	L	H	X	Data In	Upper Byte Write	Active
L	H	L	L	L	H	X	Data In	Word Write	Active

**Legend:** L= Logic0, H= Logic1, X= Don't care

### pSRAM DC Characteristics

Symbol	Item	Test Conditions	Min	Typ	Max	Unit
$I_{LI}$	Input Leakage Current	$V_{IN} = V_{SS} \text{ to } V_{CC}$	-1		1	$\mu\text{A}$
$I_{LO}$	Output Leakage Current	$CS\# = V_{IH}$ or $OE\# = V_{IH}$ or $WE\# = V_{IL}$ , $V_{IO} = V_{SS} \text{ to } V_{CC}$	-1		1	$\mu\text{A}$
$I_{CC1}$	Average Operating Current	Cycle Time = 1 $\mu\text{s}$ , 100% duty, $I_{IO} = 0 \text{ mA}$ , $CS\# \leq 0.2 \text{ V}$ , $V_{IN} \leq 0.2\text{V}$ or $V_{IN} \geq V_{CC}-0.2\text{V}$			5	mA
$I_{CC2}$		Cycle Time = Min, $I_{IO} = 0 \text{ mA}$ , 100% duty, $CS\# = V_{IL}$ , $V_{IN} = V_{IH}$ or $V_{IL}$			20	mA
$V_{OL}$	Output Low Voltage	$I_{OL} = 0.1 \text{ mA}$			0.1	V
$V_{OH}$	Output High Voltage	$I_{OH} = -0.1 \text{ mA}$	$V_{CC}-0.1 \text{ V}$			V
$I_{SB1}$	Standby Current (CMOS)	$CS\# \geq V_{CC}-0.2\text{V}$ , Other Inputs = $0 \sim V_{CC}$			70	$\mu\text{A}$



## pSRAM CHARACTERISTICS

### pSRAM AC Characteristics

Parameter List		Symbol	Min	Max	Units
Common	AVD# Low Pulse	$t_{AVD}$	20		ns
	Address setup to AVD# rising edge	$t_{AVDS}$	20		ns
	Address hold from AVD# rising edge	$t_{AVDH}$	5		ns
	Chip enable setup to AVD# rising edge	$t_{CSS}$	10		ns
Read	AVD# low to Data Valid time	$t_{ACC1}$		90	ns
	Address access time	$t_{ACC2}$		90	ns
	Chip Enable to data output	$t_{ACC3}$		90	ns
	Address disabled to output enable	$t_{ADOE}$	0		ns
	Output enable to valid output	$t_{OE}$		50	ns
	UB#, LB# enable to data output	$t_{UBLBA}$		40	ns
	UB#, LB# enable to Low-Z output	$t_{BLZ}$	15		ns
	Output enable to Low-Z output	$t_{OLZ}$	15		ns
	Chip disable to High-Z output	$t_{HZ}$		20	ns
	UB#, LB# disable to High-Z output	$t_{BHZ}$		15	ns
	Output disable to High-Z output	$t_{OHZ}$		15	ns
Write	AVD# low to end of write	$t_{ACW1}$		90	ns
	Address valid to end of write	$t_{ACW2}$		90	ns
	Chip enable to end of write	$t_{ACW3}$		90	ns
	Write pulse low	$t_{WRL}$	70 (Note 1)		ns
	UB#, LB# valid to end of write	$t_{BW}$	70 (Note 2)		ns
	Data to write time overlap	$t_{DW}$	35		ns
	Data hold from write time	$t_{DH}$	0		ns

**Notes:**

- $t_{WRL} (min) = 85 \text{ ns}$  for continuous write operation over 50 times. (Only in case of WE# controlled write operation)
- $t_{BW} (min) = 85 \text{ ns}$  for continuous write operation over 50 times. (Only in case of UB#, LB# controlled write operation)

## pSRAM CHARACTERISTICS

### pSRAM Device Operation

The access is performed in two stages. The first stage is address latching. The first stage takes place between points A and B in timing diagram. At this stage, the Chip Select (CS#) to the device is asserted. The random access is enabled either from the point the address becomes stable, the falling edge of the AVD# signal or from the falling edge of the last CS# signal.

The second stage is the read or write access. This takes place between points B and C in timing diagram. In case of read access, the multiplexed address/ data bus A/DQ[15-0] changes its direction. It is important to notice  $t_{OE}$  when it is dominant that the device gets into the read cycle since the address is available long before the device output is enabled.

### pSRAM Read Access

The read access (See Figures 5, 6) is initiated by applying the address to the multiplexed address/data bus A/DQ[15-0] and address bus A[19-16]. When the address is stable, the device chip select (CS#) is set active low. At point A, the AVD# signal is taken low and the latch becomes transparent. This allows the address to be propagated to the memory array. The address is stable at the rising edge of the AVD# signal. The AVD# signal goes high at point B in which the address latch is completed. At this point the read cycle is entered. The OE# signal is set active low. This changes the direction of the bus. The status of control signals UB# and LB# is set according to the access. Data is read at point C.

### pSRAM Write Access

The write access (Figures 7 and 8) is initiated by applying the address to the multiplexed address/data bus A/DQ[15-0] and the address bus A[19-16]. When the address is stable, the device chip select (CS#) is asserted active low. At point A, the AVD# signal is taken low and the latch becomes transparent. This allows the address to be propagated to the memory array. The address is stable at the rising edge of the AVD# signal. The AVD# signal goes high at point B in which the address latch is completed. At this point, the second stage of the write process is entered. Data is input to the multiplexed address/data bus. The WE# signal is set low and control signals UB# and LB# are set according to the access.

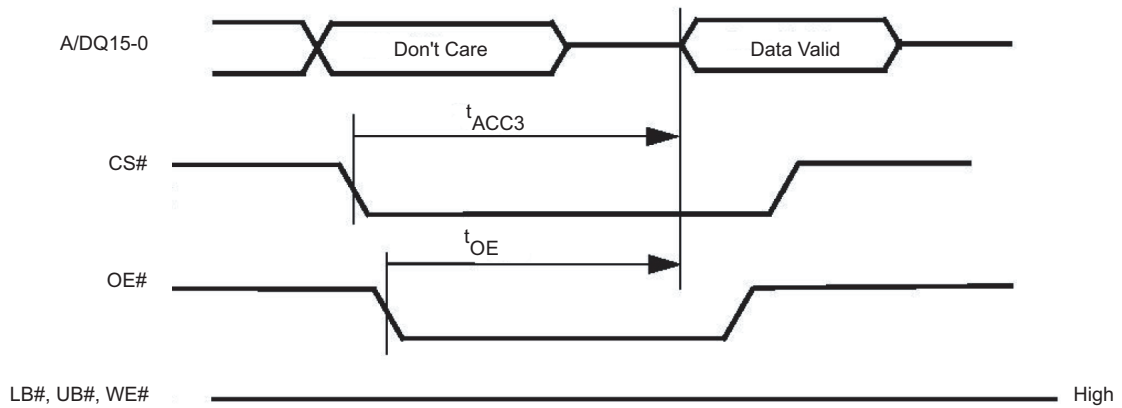
### Configuration Register Access

A configuration register is needed to control the different modes of the RAM. The configuration register consists of 16 bits and it can be accessed when LB# and UB# signals are de-asserted. The AVD# signal is not used during configuration access. Configuration registers read access is shown in Figure 3 and write accesses in Figure 4.

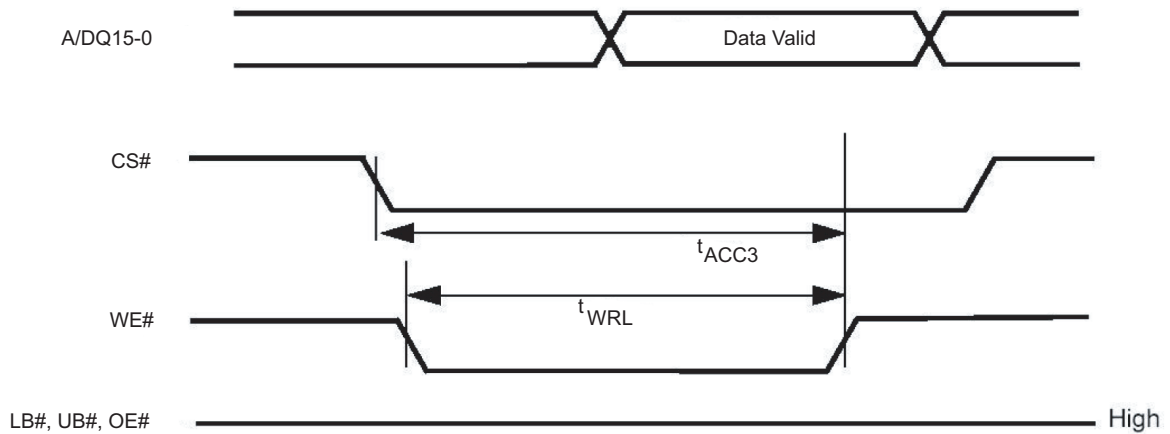
The configuration registers bits are specified in Table 7. Writing to bits 15 - 8, does not change the device operation in normal mode.

**Table 7. Configuration Register**

Bit Number	Definition	Remark
15 - 8	Don't use in normal mode	
7 - 4	Reserved for future use	
3 - 2	Reduced memory size	00 = Full array 01 = 1/2 array 10 = 1/4 array 11 = 1/8 array
1 - 0	Temperature	00 = Internal temperature sensing



**Figure 3. Configuration Register Read Access**



**Figure 4. Configuration Register Write Access**

## pSRAM CHARACTERISTICS

### pSRAM Read Access Timing Diagrams

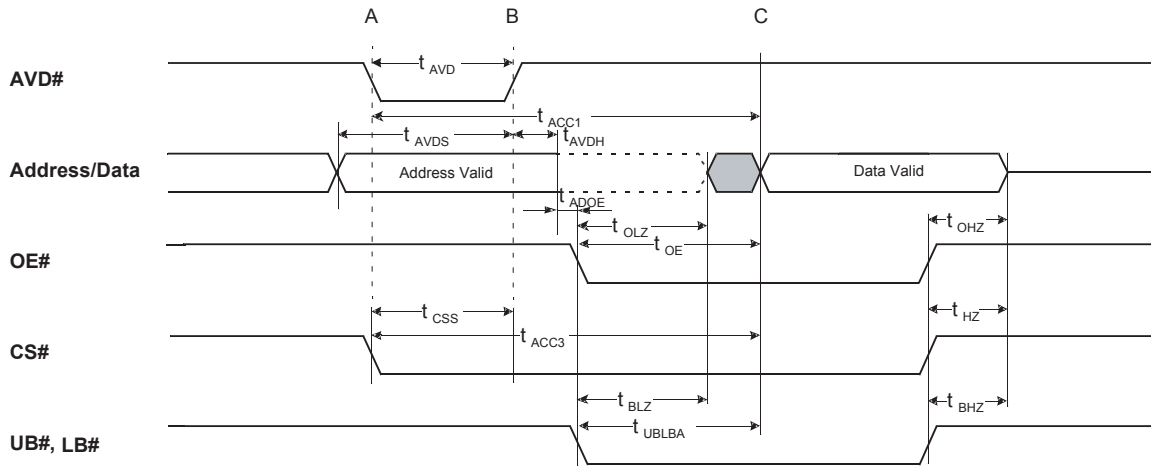


Figure 5. pSRAM Read Cycle I (WE# = V<sub>IH</sub>)

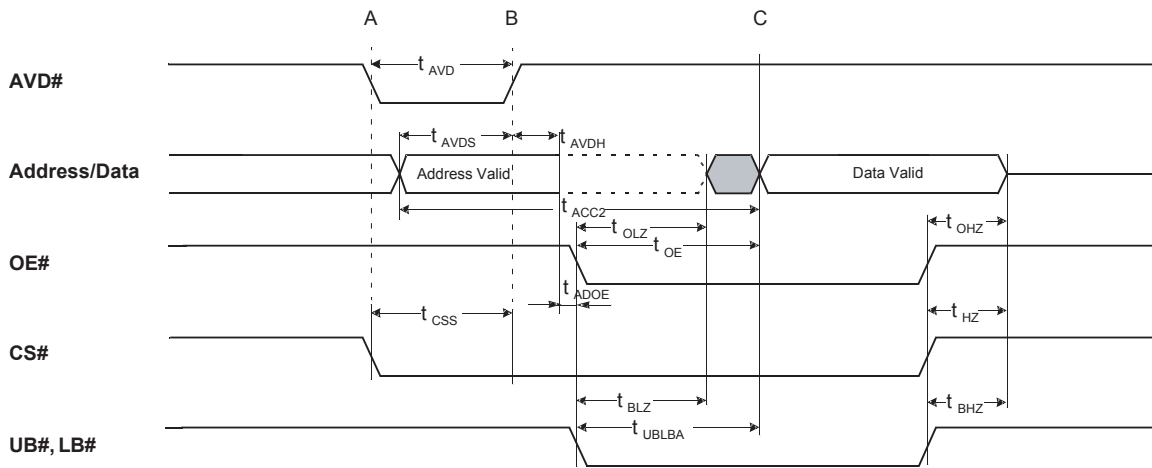


Figure 6. pSRAM Read Cycle 2 (WE# = V<sub>IH</sub>)

**Notes:**

1. To have  $t_{OE} = t_{UBLBA} = 50$  ns, time for the AVD# rising edge to OE# low and that for AVD# rising edge to UB#/LB# low must be over 30 ns at least.
2. If invalid address signals shorter than min.  $t_{ACC}$  are continuously repeated for over 4  $\mu$ s, the device needs a normal read timing ( $t_{ACC}$ ) or needs to sustain standby state for min.  $t_{ACC}$  at least once in every 4  $\mu$ s.

## pSRAM CHARACTERISTICS

### pSRAM Write Access Timing Diagrams

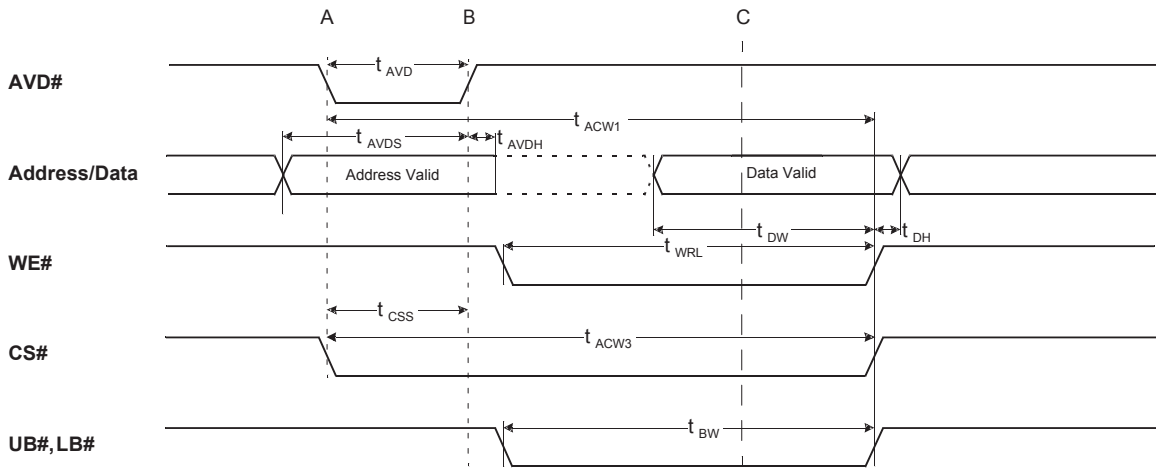


Figure 7. pSRAM Write Cycle I (OE# = V<sub>IH</sub>)

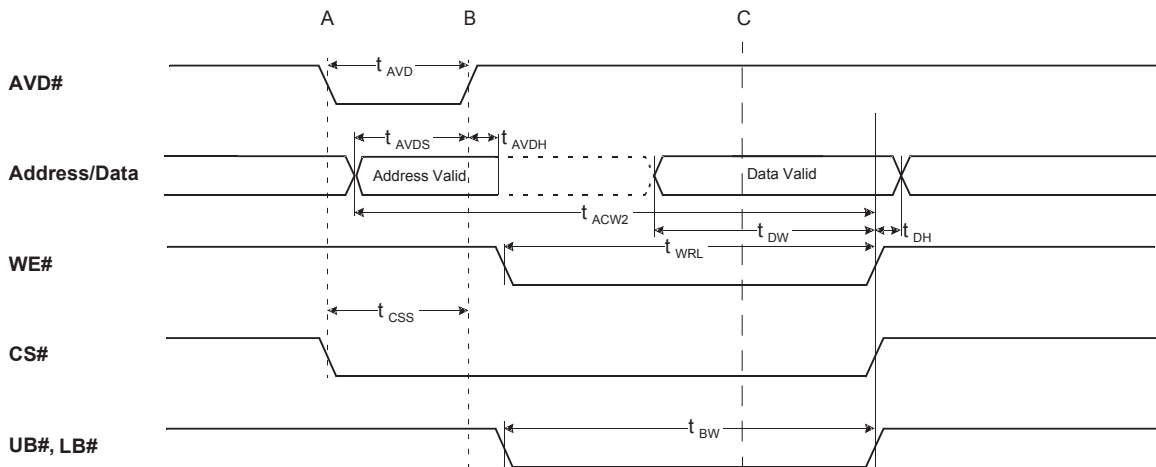


Figure 8. pSRAM Write Cycle 2 (OE# = V<sub>IH</sub>)

**Notes:**

1. A write occurs during the overlap ( $t_{WRL}$ ) of low CS#, low WE# and low UB# or LB#. A write begins at the last transition among low CS# and low WE# with asserting UB# or LB# low for single byte operation or simultaneously asserting UB# and LB# low for word operation. A write ends at the earliest transition among high CS# and high WE#. The  $t_{WRL}$  is measured from the beginning of write to the end of write.

## Revision Summary

### Revision A (December 8, 2003)

Initial Release.

### Revision A+I (February 5, 2004)

#### **Global**

Converted datasheet to Preliminary to Advanced.

#### **Product Selector Guide**

Added additional MCP Model Numbers.

#### **Ordering Information**

Updated Ordering options to reflect new Model Numbers.

Added new Valid Combinations and Package Markings to table.

#### **Device History**

Updated to reflect addition of Model Numbers.

#### **pSRAM Device Bus Operations**

Added two rows for Configuration Register Read/Write Access Mode.

#### **Trademarks and Notice**

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