Revision History

512K x16 bit Super Low Power and Low Voltage Full CMOS Static RAM

Revision No	History	Date	Remark
1.0	Initial Issue	August 2010	Preliminary
2.0	tDW updated to 25ns	October 2012	
3.0	Update USA HQ moved - change of address	September 2014	

Alliance Memory Inc. 511 Taylor Way, San Carlos, CA 94070
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FEATURES

- Process Technology : 0.15μm Full CMOS
- Organization : 512K x 16 bit
- Power Supply Voltage : 2.7V ~ 3.6V
- Low Data Retention Voltage : 1.5V(Min.)
- Three state output and TTL Compatible
- Package Type : 48-FPBGA
- dual CS – A6 is CS2
- All parts are ROHS Compliant

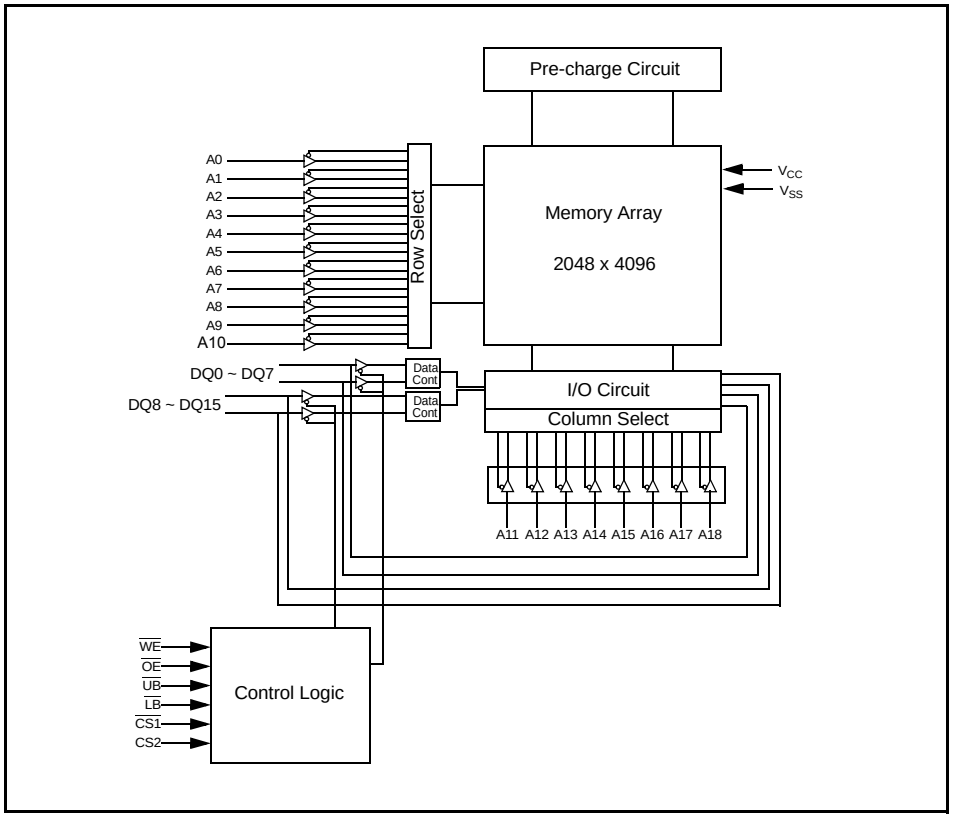
GENERAL DESCRIPTION

The AS6C8016A families are fabricated by advanced full CMOS process technology. The families support industrial temperature range and Chip Scale Package for user flexibility of system design. The families also support low data retention voltage for battery back- up operation with low data retention current.

PRODUCT FAMILY

Product Family	Operating Temperature	Vcc Range	Speed	Power Dissipation		PKG Type
				Standby (I_{SB1}, Typ.)	Operating (I_{CC1}.Max.)	
AS6C8016A-55BIN	Industrial (-40 ~ 85°C)	2.7 ~ 3.6 V	55 ns	2 μA[1)]	4 mA	48-FPBGA

FUNCTIONAL BLOCK DIAGRAM



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PIN CONFIGURATIONS

FPBGA-48 : Top view(ball down) - dual CS – A6 is CS2

	1	2	3	4	5	6
A	$\overline{LB}$	$\overline{OE}$	A0	A1	A2	CS2
B	DQ8	$\overline{UB}$	A3	A4	$\overline{CS\ 1}$	DQ0
C	DQ9	DQ10	A5	A6	DQ1	DQ2
D	V_{SS}	DQ11	A17	A7	DQ3	V_{CC}
E	V_{CC}	DQ12	NC	A16	DQ4	V_{SS}
F	DQ14	DQ13	A14	A15	DQ5	DQ6
G	DQ15	NC	A12	A13	$\overline{WE}$	DQ7
H	A18	A8	A9	A10	A11	NC

PIN DESCRIPTION

Name	Function	Name	Function
$\overline{CS1}$, CS2	Chip Select inputs	V_{CC}	Power Supply
$\overline{OE}$	Output Enable input	V_{SS}	Ground
$\overline{WE}$	Write Enable input	$\overline{UB}$	Upper Byte (DQ8~DQ15)
A0~A18	Address inputs	$\overline{LB}$	Lower Byte (DQ0~DQ7)
DQ0~DQ15	Data inputs/outputs	NC	No Connection

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ABSOLUTE MAXIMUM RATINGS[1)]

Parameter	Symbol	Ratings	Unit
Voltage on Any Pin Relative to Vss	V_{IN}, V_{OUT}	-0.2 to 4.0	V
Voltage on Vcc supply relative to Vss	V_{CC}	-0.2 to 4.0	V
Power Dissipation	P_D	1.0	W
Operating Temperature	T_A	-40 to 85	^oC

1. Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Functional operation should be restricted to recommended operating condition. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

FUNCTIONAL DESCRIPTION

$\overline{CS1}$	CS2	$\overline{OE}$	$\overline{WE}$	$\overline{LB}$	$\overline{UB}$	DQ0~7	DQ8~15	Mode	Power
H	X	X	X	X	X	High-Z	High-Z	Deselected	Stand by
X	L	X	X	X	X	High-Z	High-Z	Deselected	Stand by
X	X	X	X	H	H	High-Z	High-Z	Deselected	Stand by
L	H	H	H	L	X	High-Z	High-Z	Output Disabled	Active
L	H	H	H	X	L	High-Z	High-Z	Output Disabled	Active
L	H	L	H	L	H	Data Out	High-Z	Lower Byte Read	Active
L	H	L	H	H	L	High-Z	Data Out	Upper Byte Read	Active
L	H	L	H	L	L	Data Out	Data Out	Word Read	Active
L	H	X	L	L	H	Data In	High-Z	Lower Byte Write	Active
L	H	X	L	H	L	High-Z	Data In	Upper Byte Write	Active
L	H	X	L	L	L	Data In	Data In	Word Write	Active

NOTE: X means don't care. (Must be low or high state)

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RECOMMENDED DC OPERATING CONDITIONS [1)]

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{CC}	2.7	3.3	3.6	V
Ground	V_{SS}	0	0	0	V
Input high voltage	V_{IH}	2.2	-	V_{CC} + 0.2[2)]	V
Input low voltage	V_{IL}	-0.2[3)]	-	0.6	V

1. TA= -40 to 85°C, otherwise specified
2. Overshoot: VCC +2.0 V in case of pulse width ≤ 20ns
3. Undershoot: -2.0 V in case of pulse width ≤ 20ns
4. Overshoot and undershoot are sampled, not 100% tested.

CAPACITANCE[1)] (f =1MHz, T_A=25°C)

Item	Symbol	Test Condition	Min	Max	Unit
Input capacitance	C_{IN}	V_{IN}=0V	-	8	pF
Input/Output capacitance	C_{IO}	V_{IO}=0V	-	10	pF

1. Capacitance is sampled, not 100% tested

DC AND OPERATING CHARACTERISTICS

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input leakage current	I_{LI}	$V_{IN}=V_{SS}$ to V_{CC}		-1	-	1	μA
Output leakage current	I_{LO}	$\overline{CS1}=V_{IH}$ or CS2=V_{IL} or $\overline{OE}=V_{IH}$ or $\overline{WE}=V_{IL}$ or $\overline{LB}$=$\overline{UB}=V_{IH}$ $V_{IO}=V_{SS}$ to V_{CC}		-1	-	1	μA
Operating power supply	I_{CC}	I_{IO}=0mA, $\overline{CS1}=V_{IL}$, CS2=$\overline{WE}=V_{IH}$, $V_{IN}=V_{IH}$ or V_{IL}		-	-	2	mA
Average operating current	I_{CC1}	Cycle time=1μs, 100% duty, I_{IO}=0mA, $\overline{CS1}$≤0.2V, CS2≥V_{CC}-0.2V, $\overline{LB}$≤0.2V or/and $\overline{UB}$≤0.2V, V_{IN}≤0.2V or V_{IN}≥V_{CC}-0.2V		-	-	4	mA
	I_{CC2}	Cycle time = Min, I_{IO}=0mA, 100% duty, $\overline{CS1}=V_{IL}$, CS2=V_{IH}, $\overline{LB}=V_{IL}$ or/and $\overline{UB}=V_{IL}$, $V_{IN}=V_{IL}$ or V_{IH}	55ns	-	-	35	mA
Output low voltage	V_{OL}	I_{OL} = 2.1mA		-	-	0.4	V
Output high voltage	V_{OH}	I_{OH} = -1.0mA		2.4	-	-	V
Standby Current (TTL)	I_{SB}	$\overline{CS1}=V_{IH}$, CS2=V_{IL}, Other inputs=V_{IH} or V_{IL}		-	-	0.5	mA
Standby Current (CMOS)	I_{SB1}	$\overline{CS1}$≥V_{CC}-0.2V, CS2≥V_{CC}-0.2V ($\overline{CS1}$ controlled) or 0V≤CS2≤0.2V (CS2 controlled), Other inputs = 0~V_{CC} (Typ. condition : V_{CC}=3.3V @ 25°C) (Max. condition : V_{CC}=3.6V @ 85°C)	LF	-	2 [1)]	15	μA

1. Typical values are measured at Vcc=3.3V, T_A=25°C and not 100% tested.

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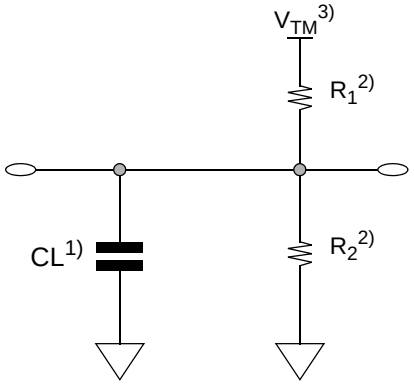
AC OPERATING CONDITIONS

Test Conditions (Test Load and Test Input/Output Reference)
Input Pulse Level: 0.4 to 2.4V
Input Rise and Fall Time: 5ns
Input and Output reference Voltage: 1.5V
Output Load (See right): $CL^{1)}$ = 100pF+ 1 TTL (70nsec)
$CL^{1)}$ = 30pF + 1 TTL (45ns/55ns)

1. Including scope and Jig capacitance
2. R_1=3070Ω, R_2=3150Ω
3. V_{TM}=2.8V
4. CL = 5pF + 1 TTL (measurement with t_{LZ}, t_{HZ}, t_{OLZ}, t_{OHZ}, t_{WHZ})



READ CYCLE (V_{cc} =2.7 to 3.6V, Gnd = 0V, T_A = -40°C to +85°C)

Parameter	Symbol	55ns		Unit
		Min	Max	
Read cycle time	t_{RC}	55	-	ns
Address access time	t_{AA}	-	55	ns
Chip select to output	t_{CO1},t_{CO2}	-	55	ns
Output enable to valid output	t_{OE}	-	35	ns
$\overline{UB}$, $\overline{LB}$ access time	t_{BA}		55	ns
Chip select to low-Z output	t_{LZ1},t_{LZ2}	5	-	ns
$\overline{UB}$, $\overline{LB}$ enable to low-Z output	t_{BLZ}	5	-	ns
Output enable to low-Z output	t_{OLZ}	5	-	ns
Chip disable to high-Z output	t_{HZ1},t_{HZ2}	0	20	ns
$\overline{UB}$, $\overline{LB}$ disable to how-Z output	t_{BHZ}	0	20	ns
Output disable to high-Z output	t_{OHZ}	0	20	ns
Output hold from address change	t_{OH}	10	-	ns

WRITE CYCLE (V_{cc} =2.7 to 3.6V, Gnd = 0V, T_A = -40°C to +85°C)

Parameter	Symbol	55ns		Unit
		Min	Max	
Write cycle time	t_{WC}	55	-	ns
Chip select to end of write	t_{CW1},t_{CW2}	45	-	ns
Address setup time	t_{As}	0	-	ns
Address valid to end of write	t_{AW}	45	-	ns
$\overline{UB}$, $\overline{LB}$ valid to end of write	t_{BW}	45	-	ns
Write pulse width	t_{WP}	45	-	ns
Write recovery time	t_{WR}	0	-	ns
Write to output high-Z	t_{WHZ}	0	20	ns
Data to write time overlap	t_{DW}	25		ns
Data hold from write time	t_{DH}	0	-	ns
End write to output low-Z	t_{OW}	5		ns

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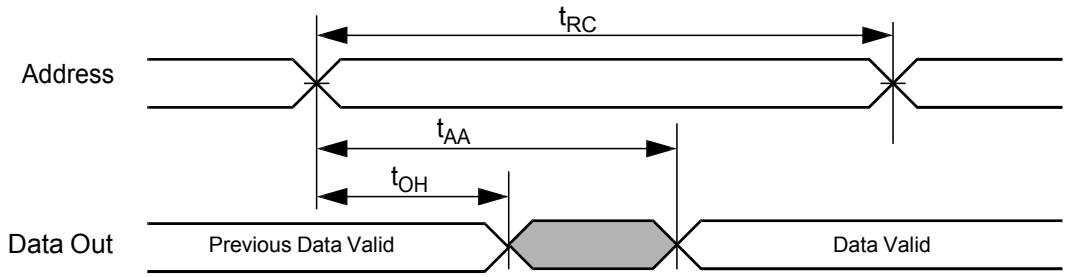
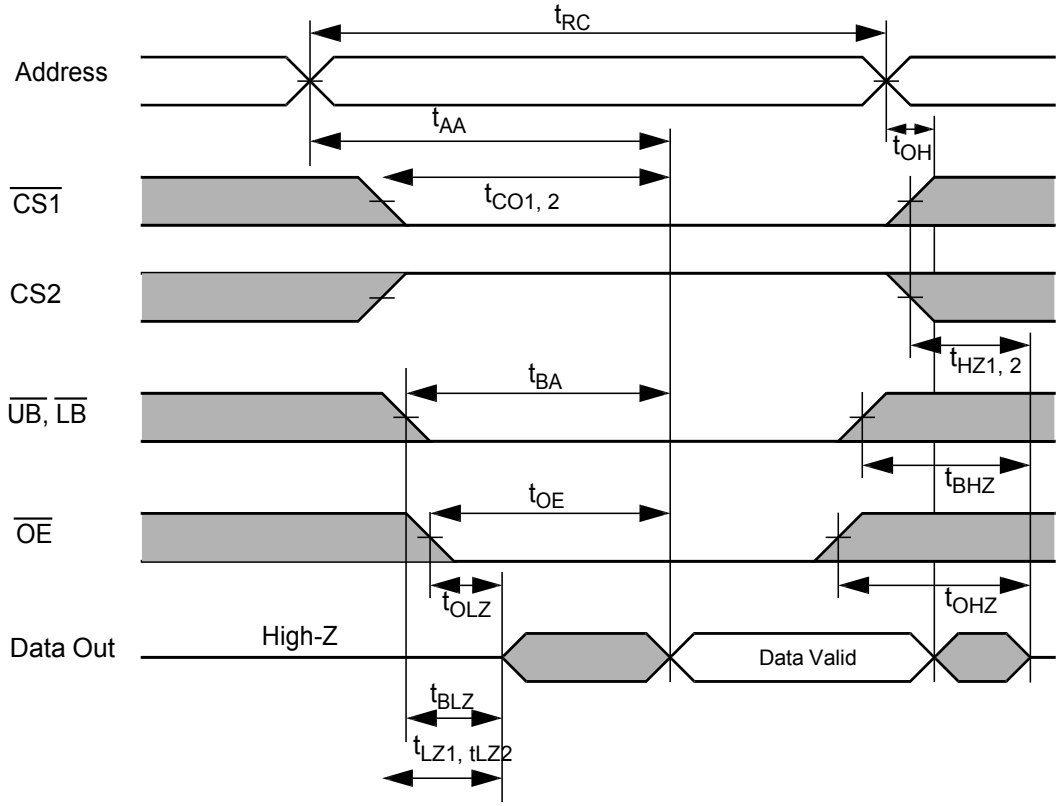
TIMING DIAGRAMS

TIMING WAVEFORM OF READ CYCLE (1) (Address Controlled, $\overline{CS1}$=$\overline{OE}$=V_{IL}, CS2=$\overline{WE}$=V_{IH}, $\overline{UB}$ or/and $\overline{LB}$=V_{IL})



TIMING WAVEFORM OF READ CYCLE (2) ($\overline{WE}$ = V_{IH})



NOTES (READ CYCLE)

1. $t_{HZ1,\ 2}$ and t_{OHZ} are defined as the outputs achieve the open circuit conditions and are not referenced to output voltage levels.
2. At any given temperature and voltage condition, $t_{HZ1,\ 2}$(Max.) is less than $t_{LZ1,\ 2}$(Min.) both for a given device and from device to device interconnection.

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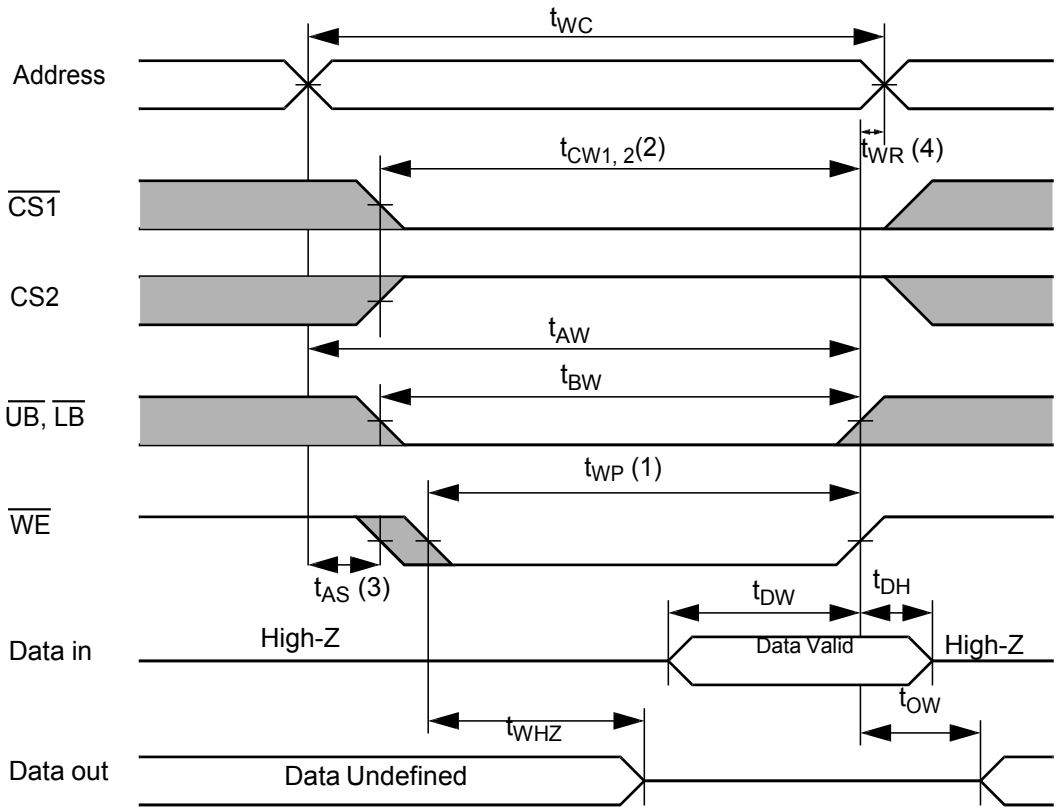
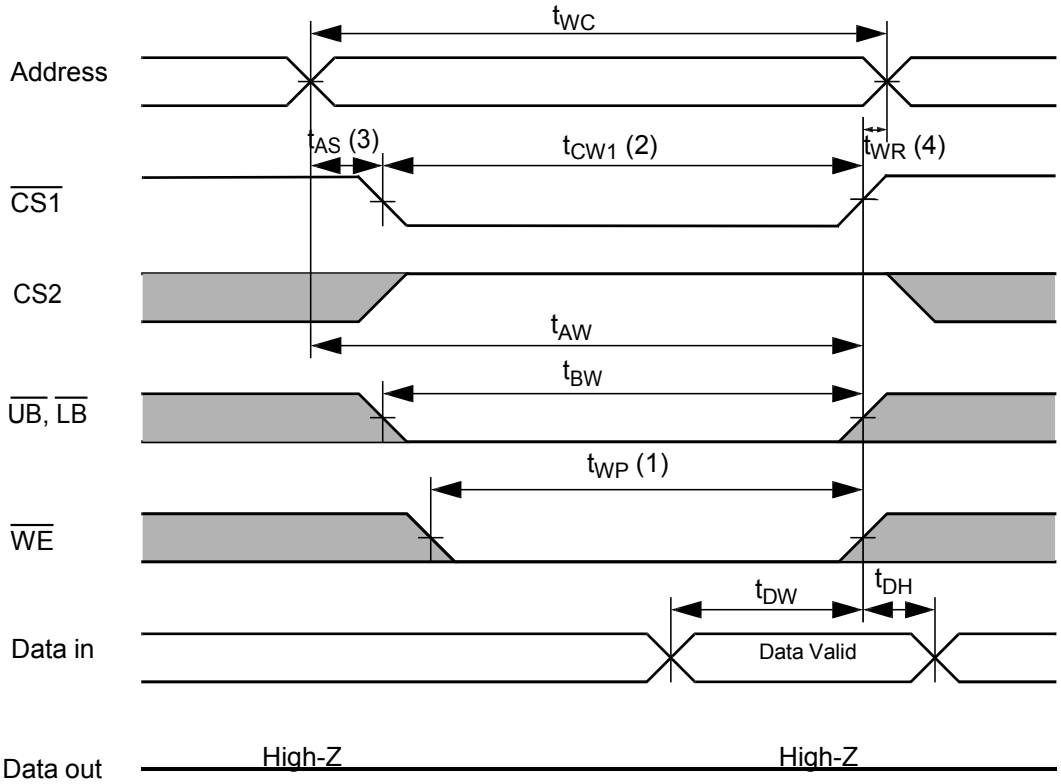
TIMING WAVEFORM OF WRITE CYCLE (1) ($\overline{WE}$ Controlled)



TIMING WAVEFORM OF WRITE CYCLE (2) ($\overline{CS1}$ Controlled)



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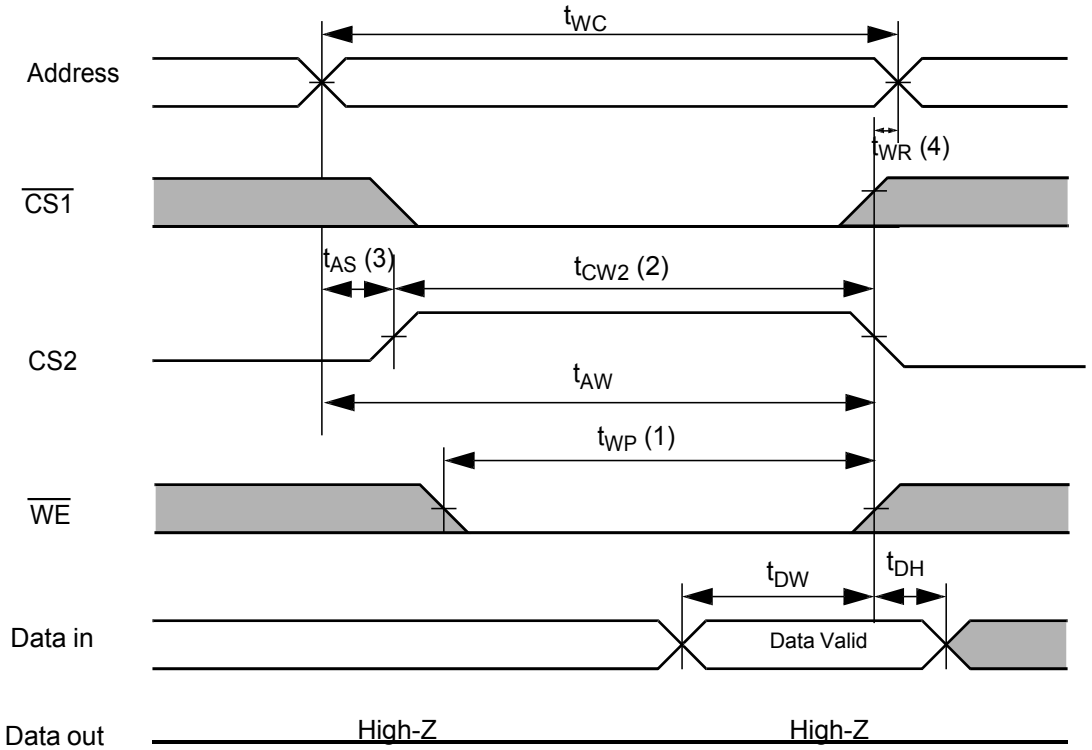
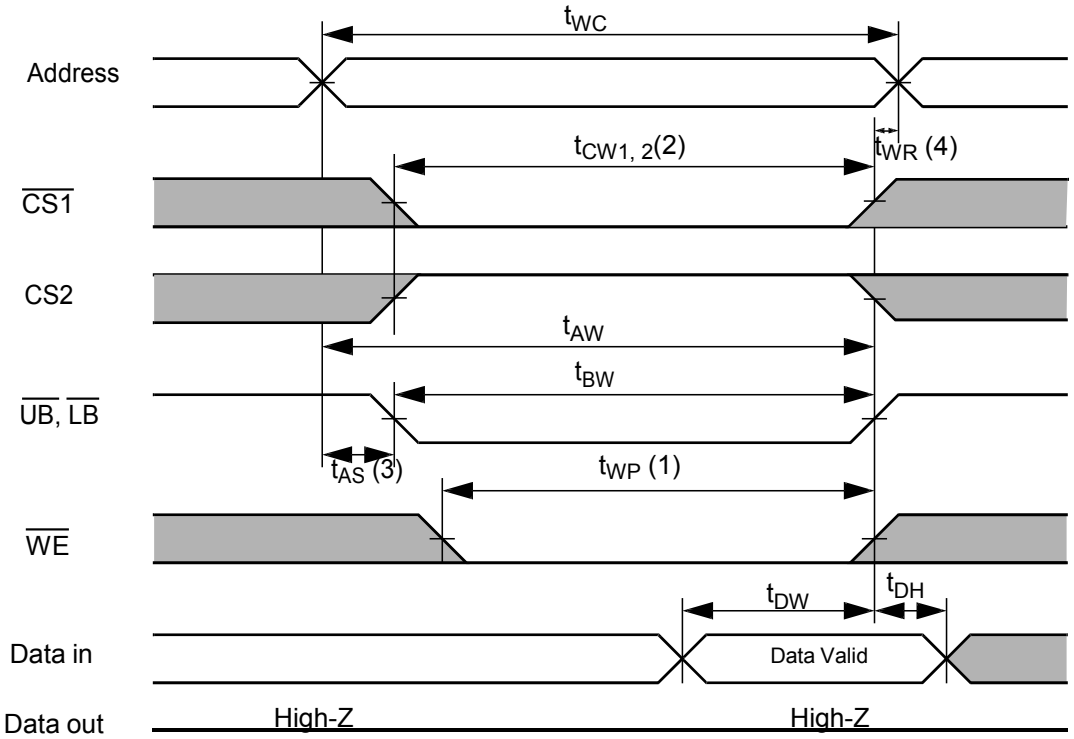
TIMING WAVEFORM OF WRITE CYCLE (3) (CS2 Controlled)



TIMING WAVEFORM OF WRITE CYCLE (4) ($\overline{UB}$, $\overline{LB}$ Controlled)



NOTES (WRITE CYCLE)

1. A write occurs during the overlap (t_{WP}) of low $\overline{CS1}$, a high CS2 and low $\overline{WE}$. A write begins at the latest transition among $\overline{CS1}$ goes low, CS2 goes high and $\overline{WE}$ goes low. A write ends at the earliest transition among $\overline{CS1}$ goes high, CS2 goes low and $\overline{WE}$ goes high. The t_{WP} is measured from the beginning of write to the end of write.
2. t_{CW} is measured from the $\overline{CS1}$ going low or CS2 going high to end of write.
3. t_{AS} is measured from the address valid to the beginning of write.
4. t_{WR} is measured from the end or write to the address change. t_{WR} applied in case a write ends as $\overline{CS1}$ or $\overline{WE}$ going high or CS2 going low.

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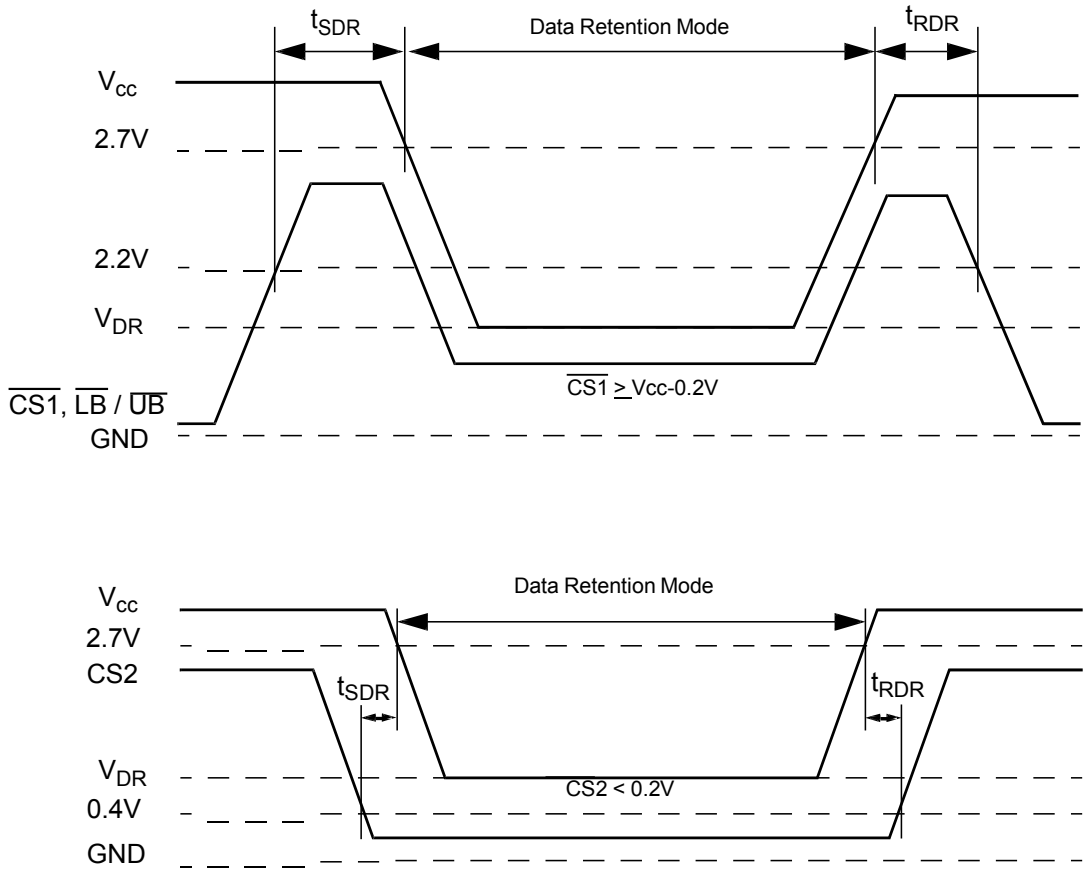
DATA RETENTION CHARACTERISTICS

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
V_{CC} for Data Retention	V_{DR}	I_{SB1} Test Condition (Chip Disabled)[1)]	1.5	-	3.6	V
Data Retention Current	I_{DR}	V_{CC}=1.5V, I_{SB1} Test Condition (Chip Disabled)[1)]	-	-	4	µA
Chip Deselect to Data Retention Time	t_{SDR}	See data retention wave form	0	-	-	ns
Operation Recovery Time	t_{RDR}		t_{RC}	-	-	

NOTES
1. See the I_{SB1} measurement condition of datasheet page 5.

DATA RETENTION WAVE FORM



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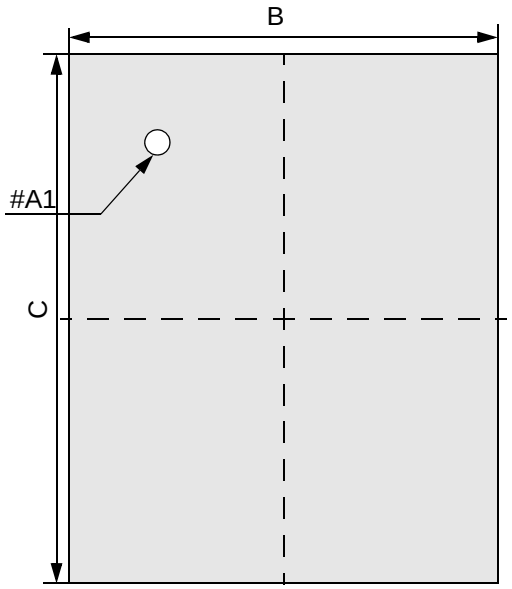
PACKAGE DIMENSION

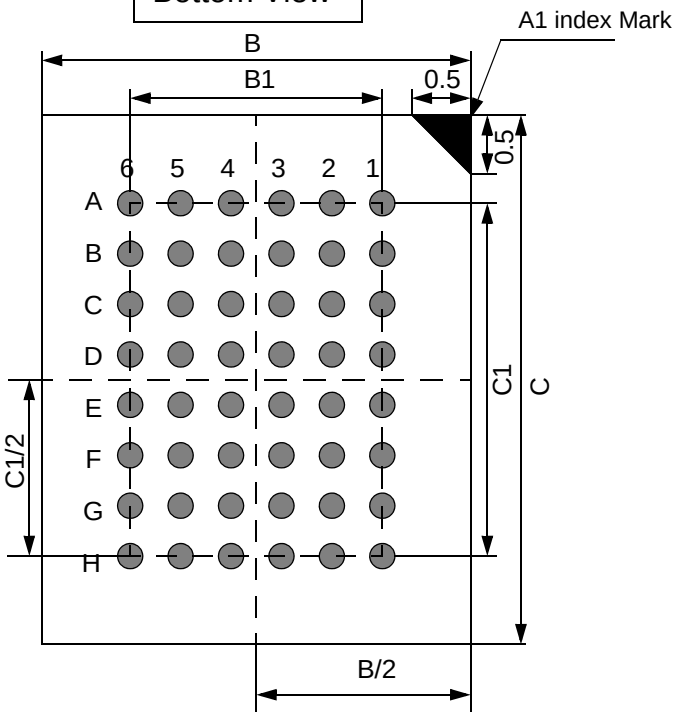
48 Ball Fine Pitch BGA (0.75mm ball pitch)

Unit: millimeters

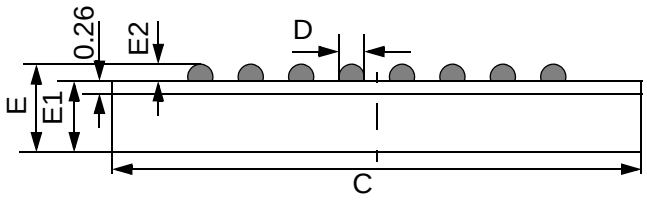
Top View



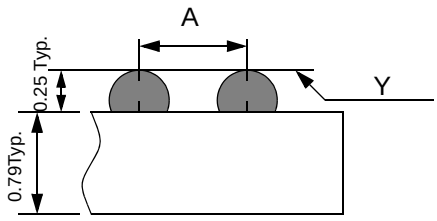
Bottom View



Side View



Detail A



	Min	Typ	Max
A	-	0.75	-
B	7.95	8.00	8.05
B1	-	3.75	-
C	9.95	10.00	10.05
C1	-	5.25	-
D	0.30	0.35	0.40
E	-	-	1.00
E1	-	-	0.70
E2	0.20	0.25	0.30
Y	-	-	0.08

NOTES.

1. Bump counts : 48(8row x 6column)
2. Bump pitch : (x,y)=(0.75x0.75) (typ.)
3. All tolerence are +/-0.050 unless otherwise specified.
4. Typ : Typical
5. Y is coplanarity : 0.08(Max)

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ORDERING INFORMATION

Alliance Part no	Organization	Vcc Range	Package	Operating Temp	Speed ns
AS6C8016A-55BIN - Tray	512K x 16	2.7V – 3.6V	48 Ball FPBGA (0.75mm ball pitch)	-40°C~85°C	55
AS6C8016A-55BINTR – Tape & Reel	512K x 16	2.7V – 3.6V	48 Ball FPBGA (0.75mm ball pitch)	-40°C~85°C	55

PART NUMBERING SYSTEM

AS6C	8016	A	-55	B	I	N
LOW POWER SRAM PREFIX	**DEVICE NUMBER 80 = 8M 16 = by 16**	**Device revision or sub-contract Wafer build supplier identification**	**Access Time**	**B = 48 Ball Fine Pitch FPBGA (0.75mm ball pitch)**	**Temperature range: I = Industrial (-40°C to 85°C)**	**N = Lead Free ROHS Compliant Part**

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