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N04M1618L1A

Advance Information

4Mb Ultra-Low Power Asynchronous Medical CMOS SRAM

256K x 16 bit

Overview

The N04M1618L1A is an integrated memory device ***intended for non life-support medical applications.*** This device is a 4 megabit memory organized as 262,144 words by 16 bits. The device is designed and fabricated using AMI Semiconductor's advanced CMOS technology with reliability inhancements for medical users. The device operates with two chip enable ($\overline{CE1}$ and CE2) controls and output enable ($\overline{OE}$) to allow for easy memory expansion. Byte controls ($\overline{UB}$ and $\overline{LB}$) allow the upper and lower bytes to be accessed independently and can also be used to deselect the device. This device is optimal for various applications where low-power is critical such as battery backup and hand-held devices. The device can operate over a very wide temperature range of -40°C to +85°C and is available in a JEDEC standard BGA package

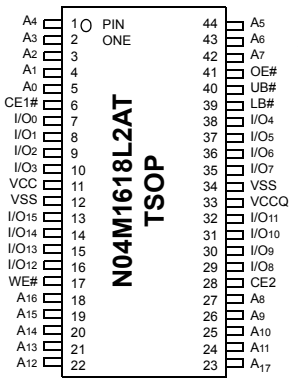
Features

- **Dual Power Supply for lowest power**
  1.4 to 2.3 Volts - VCC
  1.4 to 3.6 Volts - VCCQ
- **Very low standby current**
  400nA at 2.0V and 37 deg C Maximum
- **Very low operating current**
  0.7mA at 1.8V and 1µs (Typical)
- **Low Page Mode operating current**
  0.5mA at 1.8V and 1µs (Typical)
- **Simple memory control**
  Dual Chip Enables ($\overline{CE1}$ and CE2)
  Byte control for independent byte operation
  Output Enable ($\overline{OE}$) for memory expansion
- **Low voltage data retention**
  Vcc = 1.2V
- **Automatic power down to standby mode**
- **Special Processing to reduce Soft Error Rate (SER)**
- **Space saving BGA package available**

Product Family

Part Number	Package Type	Operating Temperature	Power Supply (Vcc)/(VccQ)	Speed	Standby Current (I_{SB}), Max	Operating Current (Icc), Max
N04M1618L1AB	48 - BGA	-40°C to +85°C	1.4V - 2.3V 1.4V - 3.6V	85ns @ 1.7V 150ns @ 1.4V	10 µA	3 mA @ 1MHz
N04M1618L1AT	44 - TSOP II					
N04M1618L1AW	Wafer					

Pin Configuration



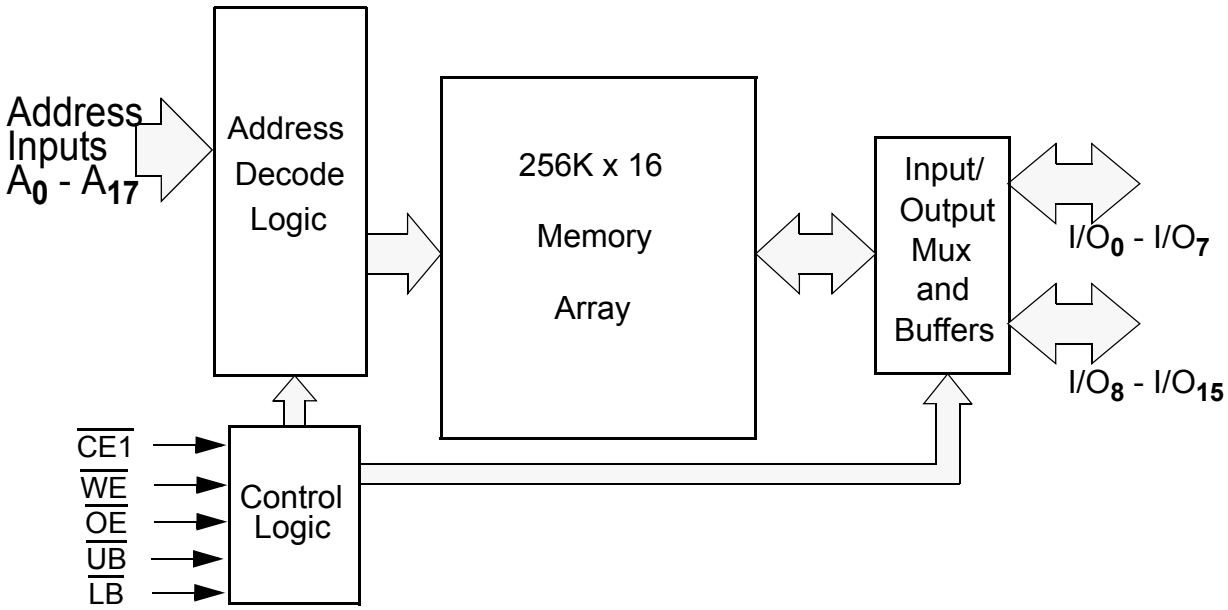
	1	2	3	4	5	6
A	LB#	OE#	A_0	A_1	A_2	CE2
B	I/O_8	UB#	A_3	A_4	CE1#	I/O_0
C	I/O_9	I/O_{10}	A_5	A_6	I/O_1	I/O_2
D	V_{SS}	I/O_{11}	A_{17}	A_7	I/O_3	V_{CCQ}
E	V_{CC}	I/O_{12}	NC	A_{16}	I/O_4	V_{SS}
F	I/O_{14}	I/O_{13}	A_{14}	A_{15}	I/O_5	I/O_6
G	I/O_{15}	NC	A_{12}	A_{13}	WE#	I/O_7
H	NC	A_8	A_9	A_{10}	A_{11}	NC

48 Pin BGA (top)
6 x 8 mm

Pin Descriptions

Pin Name	Pin Function
A_0-A_{17}	Address Inputs
$\overline{WE}$	Write Enable Input
$\overline{CE1}$, CE2	Chip Enable Input
$\overline{OE}$	Output Enable Input
$\overline{LB}$	Lower Byte Enable Input
$\overline{UB}$	Upper Byte Enable Input
I/O_0-I/O_{15}	Data Inputs/Outputs
V_{CC}	Power
V_{CCQ}	Input/Output Power
V_{SS}	Ground
NC	Not Connected

Functional Block Diagram



Functional Description

$\overline{CE1}$	CE2	$\overline{WE}$	$\overline{OE}$	I/O_0 - I/O_7	MODE	POWER
H	X	X	X	High Z	Standby[1]	Standby
X	L	X	X	High Z	Standby[1]	Standby
L	H	L	X[2]	Data In	Write[2]	Active
L	H	H	L	Data Out	Read	Active
L	H	H	H	High Z	Active	Active

1. When the device is in standby mode, control inputs ($\overline{WE}$ and $\overline{OE}$), address inputs and data input/outputs are internally isolated from any external influence and disabled from exerting any influence externally.
2. When $\overline{WE}$ is invoked, the $\overline{OE}$ input is internally disabled and has no effect on the circuit.

Capacitance[1]

Item	Symbol	Test Condition	Min	Max	Unit
Input Capacitance	C_{IN}	V_{IN} = 0V, f = 1 MHz, T_A = 25°C		8	pF
I/O Capacitance	$C_{I/O}$	V_{IN} = 0V, f = 1 MHz, T_A = 25°C		8	pF

1. These parameters are verified in device characterization and are not 100% tested

Absolute Maximum Ratings[1]

Item	Symbol	Rating	Unit
Voltage on any pin relative to V_{SS}	$V_{IN,OUT}$	–0.3 to V_{CC}+0.3	V
Voltage on V_{CC} Supply Relative to V_{SS}	V_{CC}	–0.3 to 4.5	V
Power Dissipation	P_D	500	mW
Storage Temperature	T_{STG}	–40 to 125	°C
Operating Temperature	T_A	-40 to +85	°C
Soldering Temperature and Time	T_{SOLDER}	240°C, 10sec(Lead only)	°C

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

Operating Characteristics (Over Specified Temperature Range)

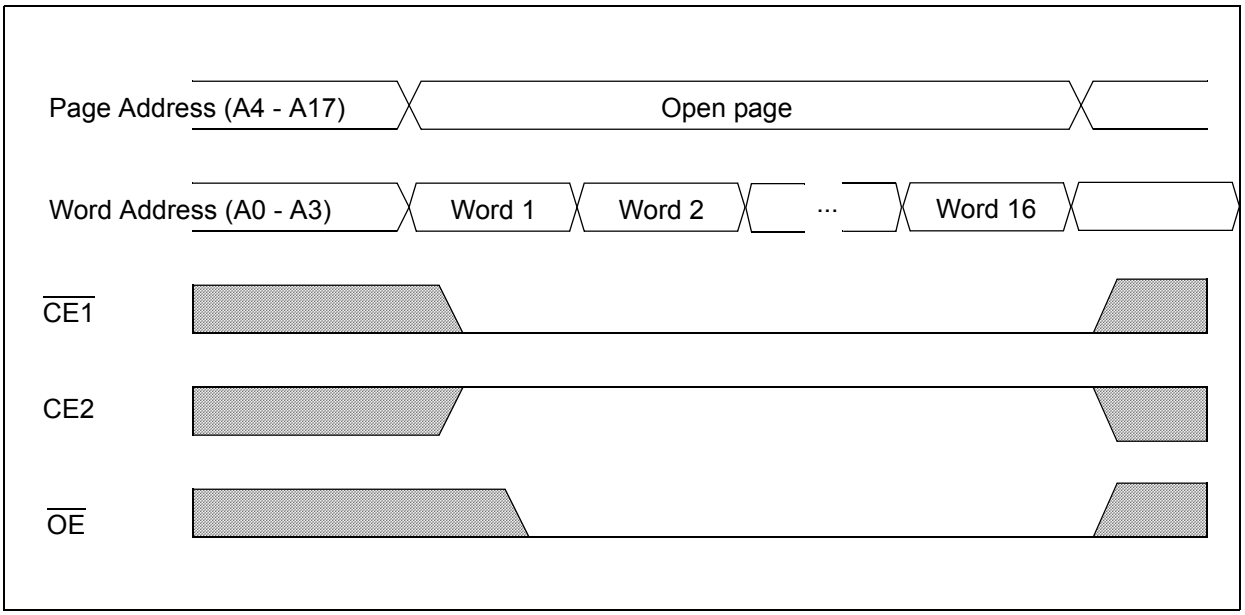
Item	Symbol	Test Conditions	Min.	Typ[1]	Max	Unit
Core Supply Voltage	V_{CC}		1.4	1.8	2.3	V
I/O Supply Voltage	V_{CCQ}	V_{CCQ} > or = V_{CC}	1.4	1.8	3.6	V
Data Retention Voltage	V_{DR}	Chip Disabled[3]	1.2			V
Input High Voltage	V_{IH}		V_{CCQ}-0.6		V_{CCQ}+0.3	V
Input Low Voltage	V_{IL}		–0.3		0.6	V
Output High Voltage	V_{OH}	I_{OH} = 0.2mA	V_{CCQ}–0.2			V
Output Low Voltage	V_{OL}	I_{OL} = -0.2mA			0.2	V
Input Leakage Current	I_{LI}	V_{IN} = 0 to V_{CC}			0.1	µA
Output Leakage Current	I_{LO}	$\overline{OE}$ = V_{IH} or Chip Disabled			0.1	µA
Read/Write Operating Supply Current @ 1 µs Cycle Time[2]	I_{CC1}	V_{CC}=2.3 V, V_{IN}=V_{IH} or V_{IL} Chip Enabled, I_{OUT} = 0		1.5	2.5	mA
Read/Write Operating Supply Current @ 85 ns Cycle Time[2]	I_{CC2}	V_{CC}=2.3 V, V_{IN}=V_{IH} or V_{IL} Chip Enabled, I_{OUT} = 0		10.0	13.0	mA
Page Mode Operating Supply Current @ 85 ns Cycle Time[2] (Refer to Power Savings with Page Mode Operation diagram)	I_{CC3}	V_{CC}=2.3 V, V_{IN}=V_{IH} or V_{IL} Chip Enabled, I_{OUT} = 0		3.5		mA
Read/Write Quiescent Operating Supply Current[3]	I_{CC4}	V_{CC}=2.3 V, V_{IN}=V_{IH} or V_{IL} Chip Enabled, I_{OUT} = 0, f = 0		0.2		µA
Standby Current[3]	I_{SB1}	V_{IN} = V_{CC} or 0V Chip Disabled t_A= 85°C, V_{CC} = 2.3 V		0.2	20.0	µA
Data Retention Current[3]	I_{DR}	V_{CC} = 1.8V, V_{IN} = V_{CC} or 0 Chip Disabled, t_A= 85°C		0.1	1.0	µA

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

2. This parameter is specified with the outputs disabled to avoid external loading effects. The user must add current required to drive output capacitance expected in the actual system.

3. This device assumes a standby mode if the chip is disabled ($\overline{CE1}$ high or CE2 low). In order to achieve low standby current all inputs must be within 0.2 volts of either VCC or VSS.

Power Savings with Page Mode Operation ($\overline{WE}$ = V_{IH})



Note: Page mode operation is a method of addressing the SRAM to save operating current. The internal organization of the SRAM is optimized to allow this unique operating mode to be used as a valuable power saving feature.

The only thing that needs to be done is to address the SRAM in a manner that the internal page is left open and 8-bit words of data are read from the open page. By treating addresses A0-A3 as the least significant bits and addressing the 16 words within the open page, power is reduced to the page mode value which is considerably lower than standard operating currents for low power SRAMs.

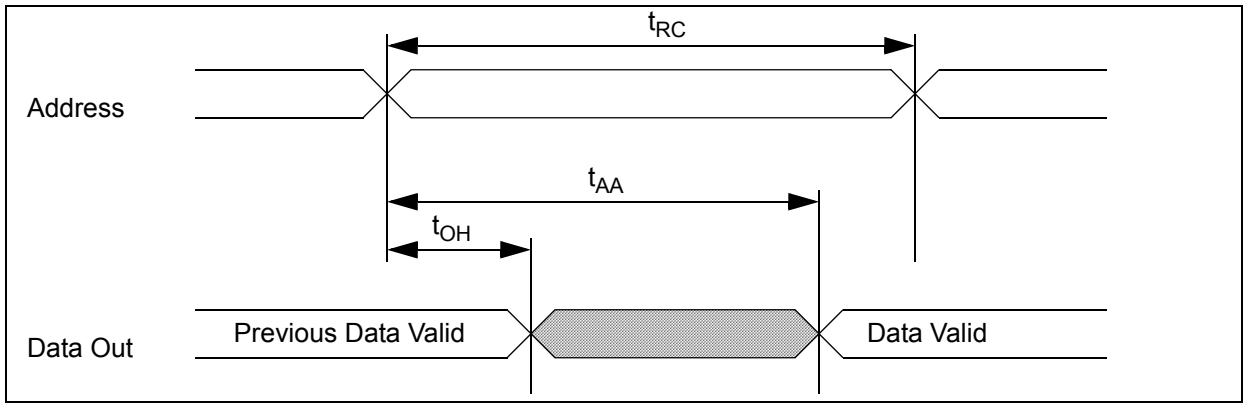
Timing Test Conditions

Item	
Input Pulse Level	$0.1V_{CC}$ to 0.9 V_{CC}
Input Rise and Fall Time	5ns
Input and Output Timing Reference Levels	0.5 V_{CC}
Output Load	CL = 30pF
Operating Temperature	-40 to +85 ^{o}C

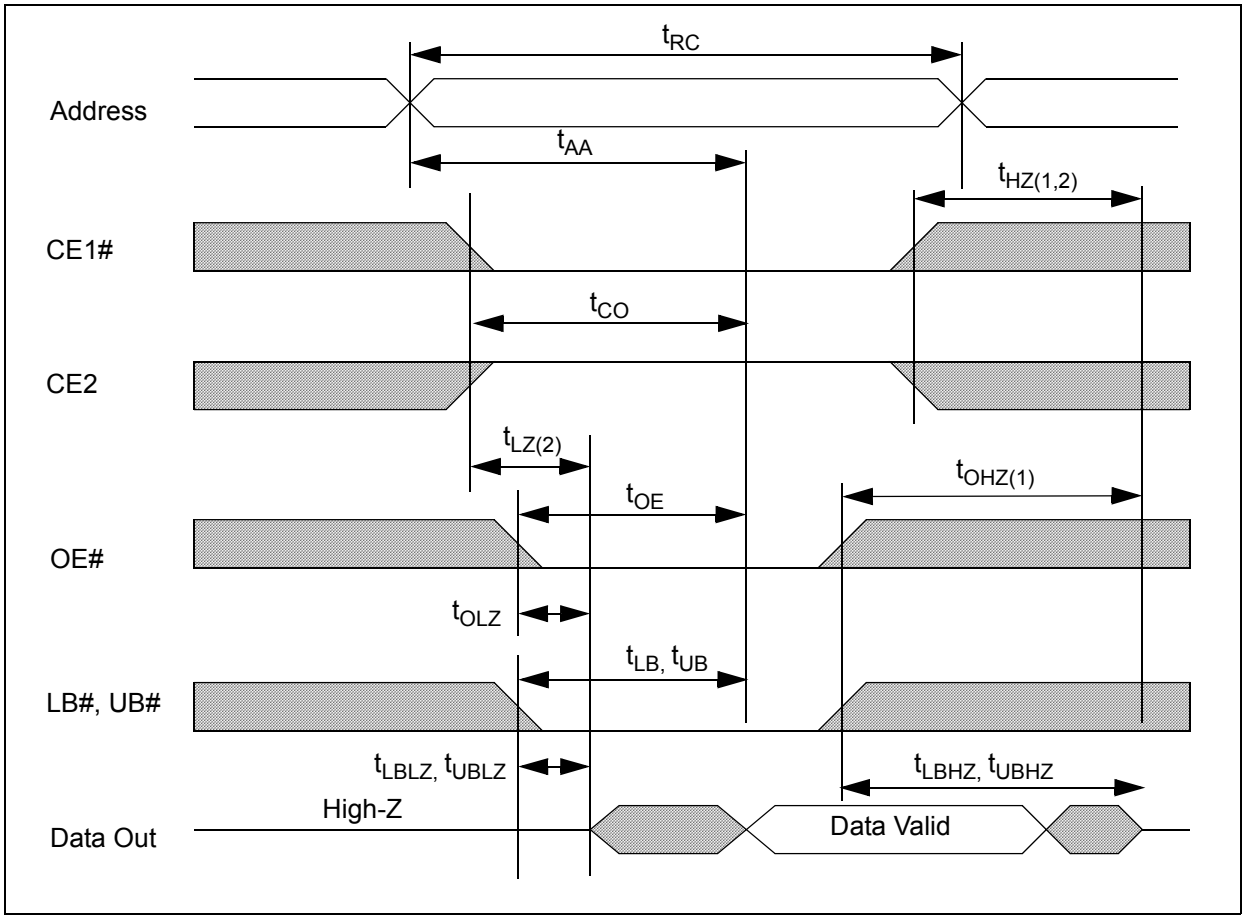
Timing V_{CCQ} > or = V_{CC}

Item	Symbol	V_{CC} = 1.4 - 2.3 V		V_{CC} = 1.7 - 2.3 V		Units
		Min.	Max.	Min.	Max.	
Read Cycle Time	t_{RC}	150		85		ns
Address Access Time	t_{AA}		150		85	ns
Chip Enable to Valid Output	t_{CO}		150		85	ns
Output Enable to Valid Output	t_{OE}		50		40	ns
Chip Enable to Low-Z output	t_{LZ}	20		10		ns
Output Enable to Low-Z Output	t_{OLZ}	20		5		ns
Chip Disable to High-Z Output	t_{HZ}	0	30	0	15	ns
Output Disable to High-Z Output	t_{OHZ}	0	30	0	15	ns
Output Hold from Address Change	t_{OH}	20		10		ns
Write Cycle Time	t_{WC}	150		85		ns
Chip Enable to End of Write	t_{CW}	75		50		ns
Address Valid to End of Write	t_{AW}	75		50		ns
Write Pulse Width	t_{WP}	50		40		ns
Address Setup Time	t_{AS}	0		0		ns
Write Recovery Time	t_{WR}	0		0		ns
Write to High-Z Output	t_{WHZ}		30		15	ns
Data to Write Time Overlap	t_{DW}	50		40		ns
Data Hold from Write Time	t_{DH}	0		0		ns
End Write to Low-Z Output	t_{OW}	10		5		ns

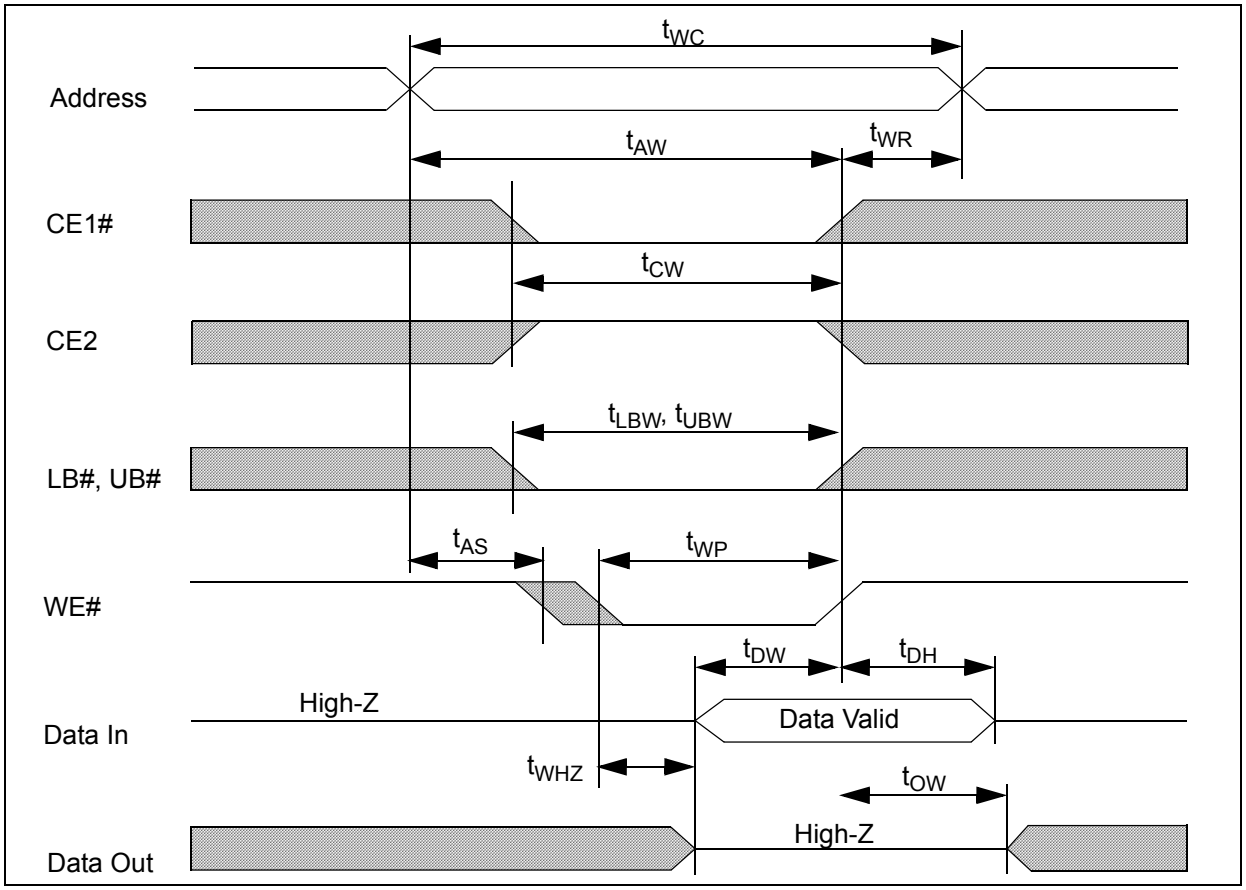
Timing of Read Cycle ($\overline{CE1}$ = $\overline{OE}$ = V_{IL}, $\overline{WE}$ = CE2 = V_{IH})



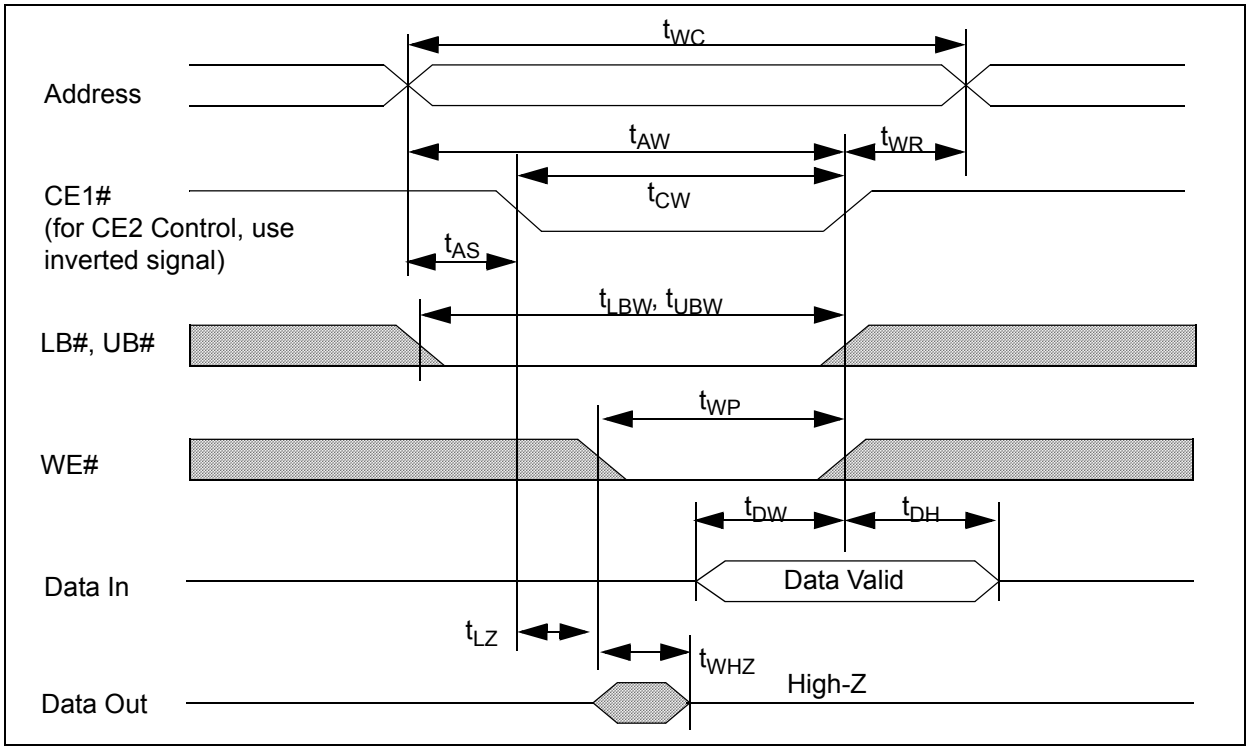
Timing Waveform of Read Cycle ($\overline{WE}$=V_{IH})



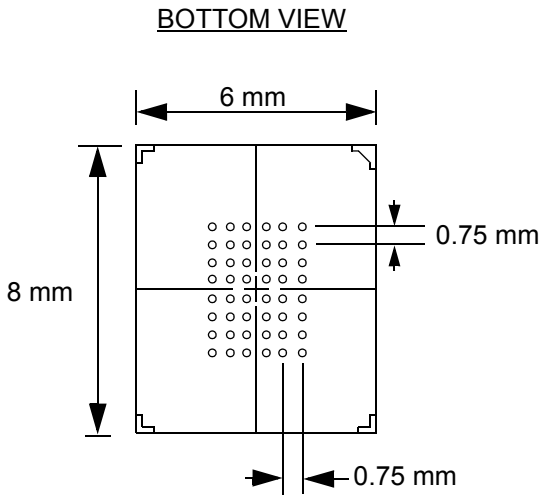
Timing Waveform of Write Cycle ($\overline{WE}$ control)



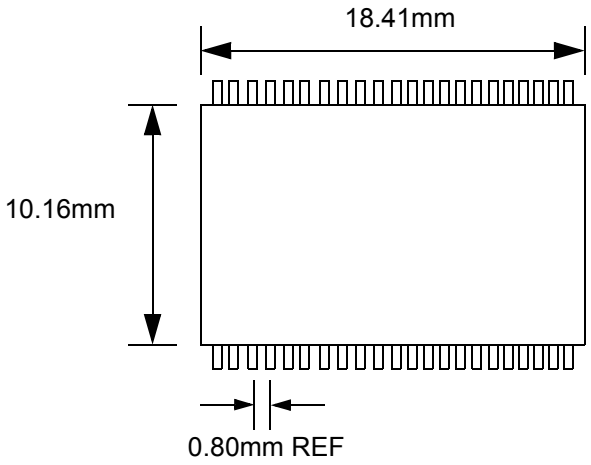
Timing Waveform of Write Cycle ($\overline{CE1}$ Control)



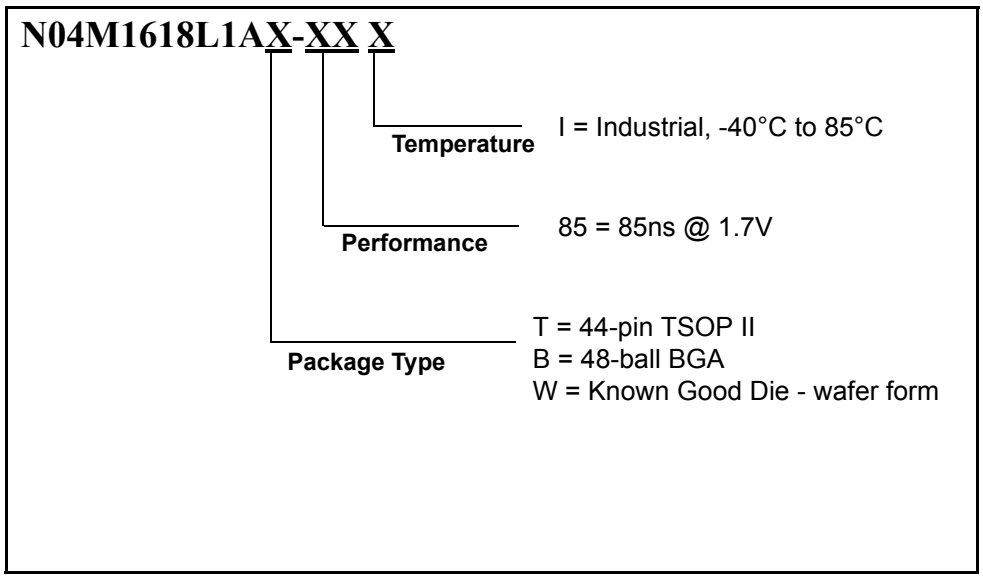
Ball Grid Array Package



32-Lead STSOP-I Package (N32)44-Lead TSOP II Package (T44)



Ordering Information



Revision History

Revision #	Date	Change Description
01	11/01/02	Initial Release
02	9/21/2006	Converted to AMI Semiconductor