

EM064L16 Family

64Kx16 bit Ultra-Low Power Asynchronous Static RAM

Overview

The EM064L16 is an integrated memory device containing a low power 1 Mbit Static Random Access Memory organized as 65,536 words by 16 bits. The base design is the same as NanoAmp's EM064U16 which is processed to operate at lower voltages. The device is fabricated using NanoAmp's advanced CMOS process and high-speed/ultra low-power/low-voltage circuit technology. The device pinout is compatible with other standard 64K x 16 SRAMs.

Features

- **Wide Voltage Range:**
2.3 to 3.6 Volts
- **Extended Temperature Range:**
-40 to +85 °C
- **Fast Cycle Time:**
 $T_{ACC} < 55 \text{ ns @ } 3.0\text{V}$
- **Very Low Operating Current:**
 $I_{CC} < 10 \text{ mA typical at } 3\text{V, } 10 \text{ Mhz}$
- **Very Low Standby Current:**
 $I_{SB} < 10 \mu\text{A @ } 55 \text{ }^\circ\text{C}$
- **44-Pin TSOP, 48-Pin BGA Available**

FIGURE 1: Pin Configurations

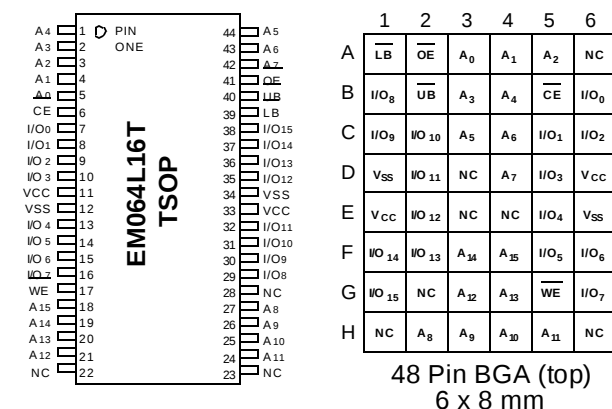


TABLE 1: Pin Descriptions

Pin Name	Pin Function
A ₀ -A ₁₅	Address Inputs
WE	Write Enable Input
CE	Chip Enable Input
OE	Output Enable Input
LB	Lower Byte Enable Input
UB	Upper Byte Enable Input
I/O ₀ -I/O ₁₅	Data Inputs/Outputs
NC	Not Connected
V _{CC}	Power
V _{SS}	Ground

FIGURE 2: Typical Operating Current Curves

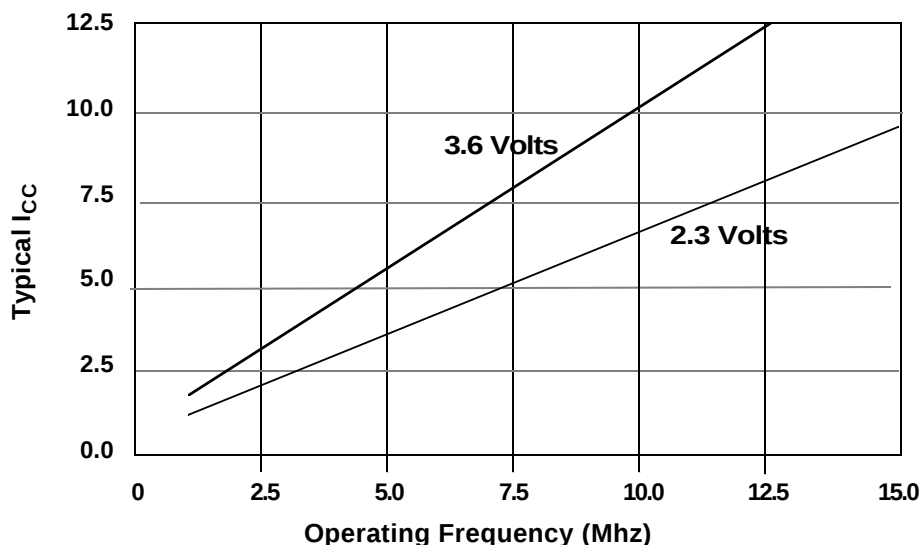
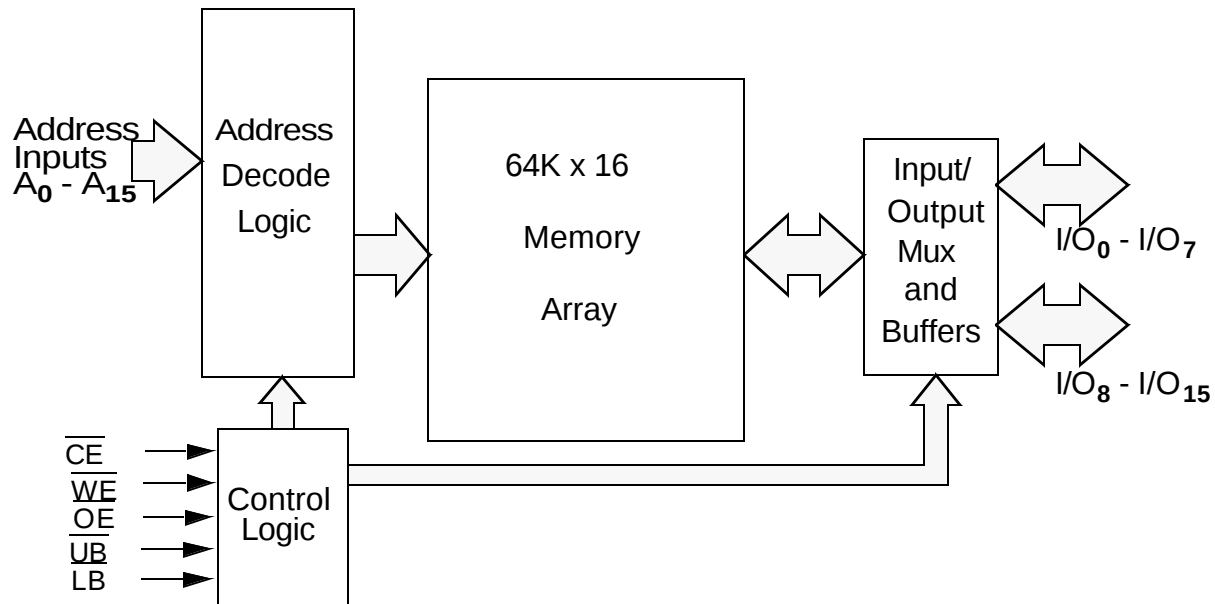


FIGURE 3: Functional Block Diagram**TABLE 2: Functional Description**

$\overline{CE}$	$\overline{WE}$	$\overline{OE}$	$\overline{UB}$	$\overline{LB}$	$I/O_0 - I/O_{15}^1$	MODE	POWER
H	X	X	X	X	High Z	Standby ²	Standby
X	X	X	H	H	High Z	Standby ²	Standby
L	L	X ³	L ¹	L ¹	Data In	Write ³	Active
L	H	L	L ¹	L ¹	Data Out	Read	Active
L	H	H	L ¹	L ¹	High Z	Active	Standby ⁴

- When $\overline{UB}$ and $\overline{LB}$ are in select mode (low), $I/O_0 - I/O_{15}$ are affected as shown. When $\overline{LB}$ only is in the select mode only $I/O_0 - I/O_7$ are affected as shown. When $\overline{UB}$ is in the select mode only $I/O_8 - I/O_{15}$ are affected as shown. If both $\overline{UB}$ and $\overline{LB}$ are in the deselected mode (high), the chip is in a standby mode regardless of the state of $\overline{CE}$.
- When the device is in standby mode, control inputs ($\overline{WE}$, $\overline{OE}$, $\overline{UB}$, and $\overline{LB}$), address inputs and data input/outputs are internally isolated from any external influence and disabled from exerting any influence externally.
- When $\overline{WE}$ is invoked, the $\overline{OE}$ input is internally disabled and has no effect on the circuit.
- The device will consume active power in this mode whenever addresses are changed. Data inputs are internally isolated from any external influence.

TABLE 3: Capacitance*

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

Note: These parameters are verified in device characterization and are not 100% tested

TABLE 4: Absolute Maximum Ratings*

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 5.0	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}	260 °C, 10sec(Lead only)	°C

* 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.

TABLE 5: Operating Characteristics (Over specified Temperature Range)

Item	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}		2.3		3.6	V
Data Retention Voltage	V_{DR}	Chip Disabled (Note 3)	1.8			V
Input High Voltage	V_{IH}		$0.7V_{CC}$		$V_{CC}+0.5$	V
Input Low Voltage	V_{IL}		-0.5		$0.3V_{CC}$	V
Output High Voltage	V_{OH}	$I_{OH} = 0.2mA$	$V_{CC}-0.2$			V
Output Low Voltage	V_{OL}	$I_{OL} = -0.2mA$			0.2	V
Input Leakage Current	I_{LI}	$V_{IN} = 0$ to V_{CC}			0.5	μA
Output Leakage Current	I_{LO}	$\overline{OE} = V_{IH}$ or Chip Disabled			0.5	μA
Read/Write Operating Supply Current @ 1 μS Cycle Time (Note 1)	I_{CC1}	$V_{CC}=3.6V$, $V_{IN}=V_{IH}$ or V_{IL} Chip Enabled, $I_{OL} = 0$			3.0	mA
Read/Write Operating Supply Current @ 70 nS Cycle Time (Note 1)	I_{CC2}	$V_{CC}=3.6V$, $V_{IN}=V_{IH}$ or V_{IL} Chip Enabled, $I_{OL} = 0$			12.0	mA
Operating Standby Current (Note 2)	I_{SB1}	$V_{IN} = V_{CC}$ or 0V Chip Disabled $t_A = 55^\circ C$, $V_{CC} = 3.3V$			10	μA
Maximum Standby Current (Note 2)	I_{SB2}	$V_{IN} = V_{CC}$ or 0V Chip Disabled $t_A = 85^\circ C$, $V_{CC} = 3.3V$			20	μA
Maximum Data Retention Current (Note 2)	I_{DR}	$V_{CC} = 2.0V$, $V_{IN} = V_{CC}$ or 0 Chip Disabled, $t_A = 85^\circ C$			10	μA

1. 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.
2. This device assumes a standby mode if the chip is disabled ($\overline{CE}$ high or $\overline{UB}$ and $\overline{LB}$ high). In order to achieve low standby current all inputs must be within 0.2 volts of either V_{CC} or V_{SS} .
3. The Chip is Disabled when $\overline{CE}$ is high or when both $\overline{UB}$ and $\overline{LB}$ are high. The Chip is Enabled when $\overline{CE}$ is low and $\overline{UB}$ or $\overline{LB}$ is low.

TABLE 6: 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 °C

TABLE 7: Timing

Item	Symbol	2.3 - 3.6 V		2.7 - 3.6 V		Units
		Min.	Max.	Min.	Max.	
Read Cycle Time	t _{RC}	70		55		ns
Address Access Time	t _{AA}		70		55	ns
Chip Enable to Valid Output	t _{CO}		70		55	ns
Output Enable to Valid Output	t _{OE}		25		20	ns
Byte Select to Valid Output	t _{LB} , t _{UB}		70		55	ns
Chip Enable to Low-Z output	t _{LZ}	10		10		ns
Output Enable to Low-Z Output	t _{OLZ}	5		5		ns
Byte Select to Low-Z Output	t _{LBZ} , t _{UBZ}	10		10		ns
Chip Disable to High-Z Output	t _{HZ}	0	20	0	20	ns
Output Disable to High-Z Output	t _{OHZ}	0	20	0	20	ns
Byte Select Disable to High-Z Output	t _{LBHZ} , t _{UBHZ}	0	20	0	20	ns
Output Hold from Address Change	t _{OH}	10		10		ns
Write Cycle Time	t _{WC}	70		55		ns
Chip Enable to End of Write	t _{CW}	50		40		ns
Address Valid to End of Write	t _{AW}	50		40		ns
Byte Select to End of Write	t _{LBW} , t _{UBW}	50		40		ns
Write Pulse Width	t _{WP}	40		0		ns
Address Setup Time	t _{AS}	0		40		ns
Write Recovery Time	t _{WR}	0		0		ns
Write to High-Z Output	t _{WHZ}		20		20	ns
Data to Write Time Overlap	t _{DW}	40		30		ns
Data Hold from Write Time	t _{DH}	0		0		ns
End Write to Low-Z Output	t _{OW}	5		10		ns

FIGURE 4: Timing of Read Cycle (1) ($\overline{\text{CE}} = \overline{\text{OE}} = V_{\text{IL}}$, $\overline{\text{WE}} = V_{\text{IH}}$)

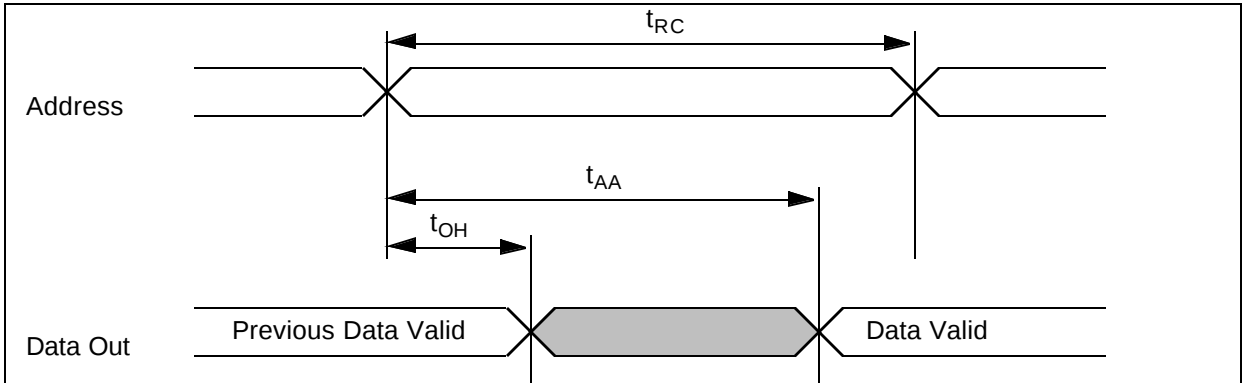


FIGURE 5: Timing Waveform of Read Cycle (2) ($\overline{\text{WE}} = V_{\text{IH}}$)

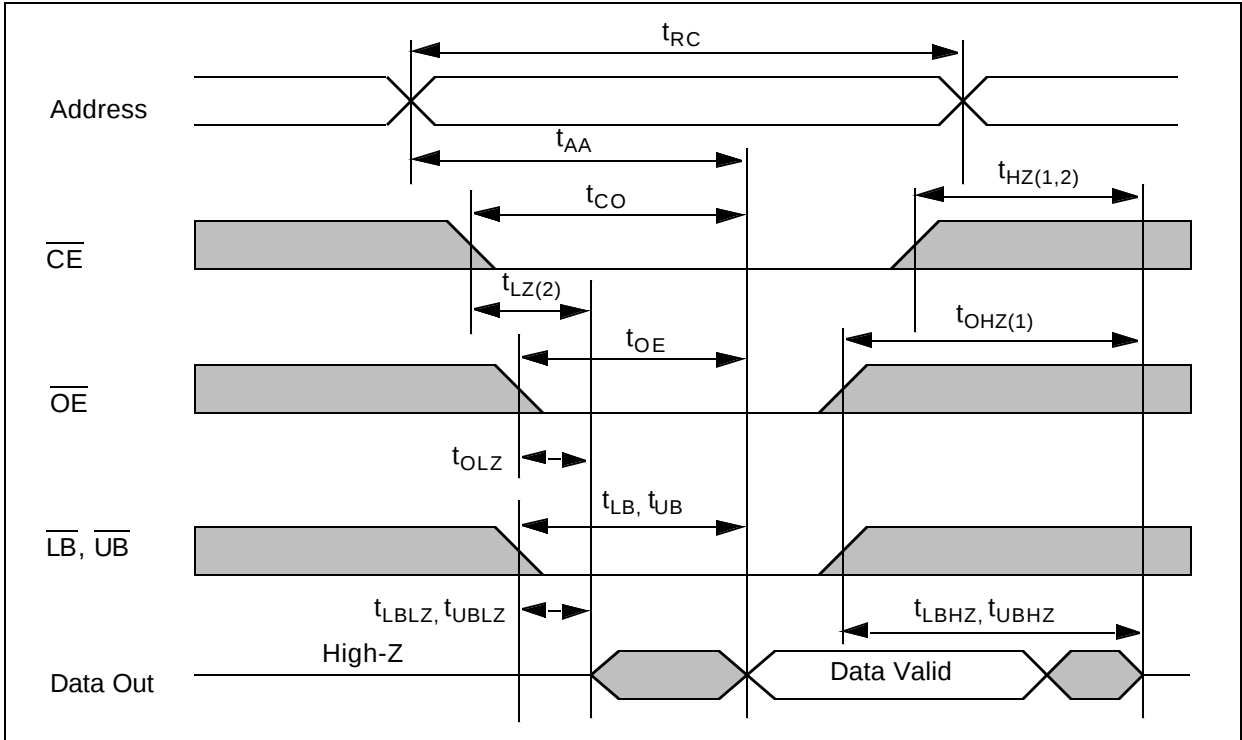


FIGURE 6: Timing Waveform of Write Cycle (1) ($\overline{\text{WE}}$ control)

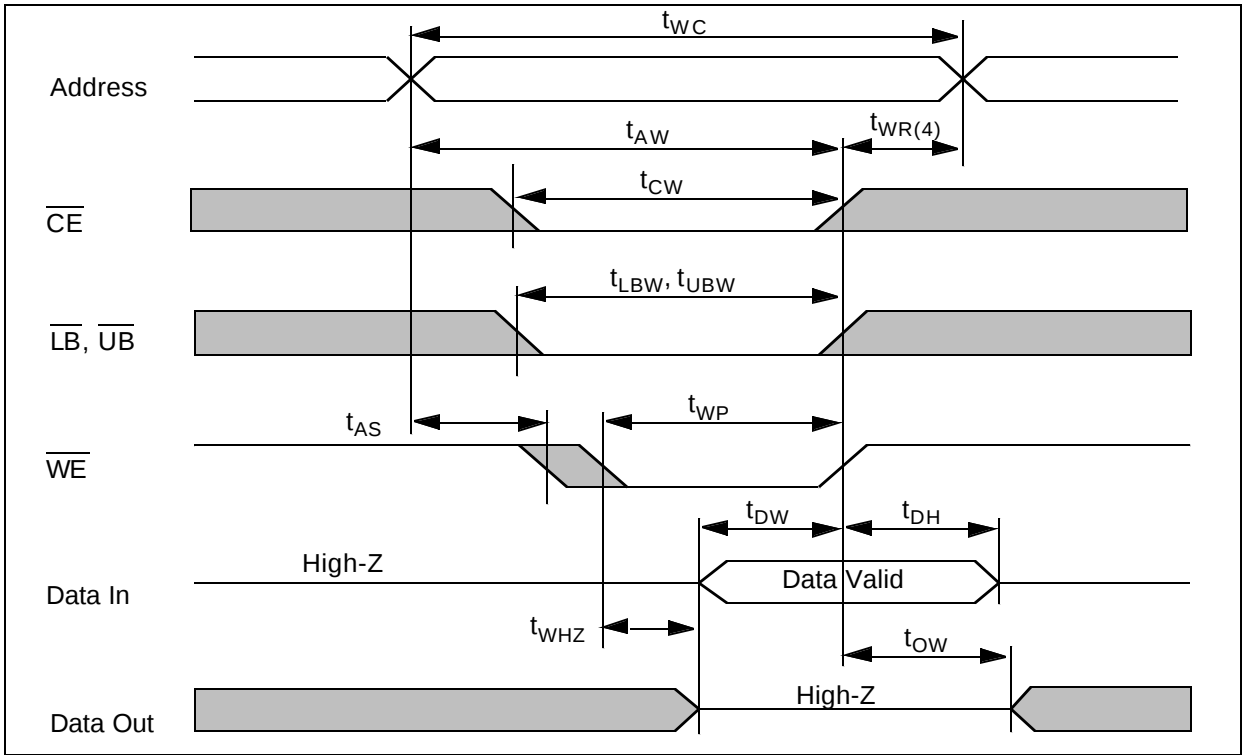


FIGURE 7: Timing Waveform of Write Cycle (2) ($\overline{\text{CE}}$ Control)

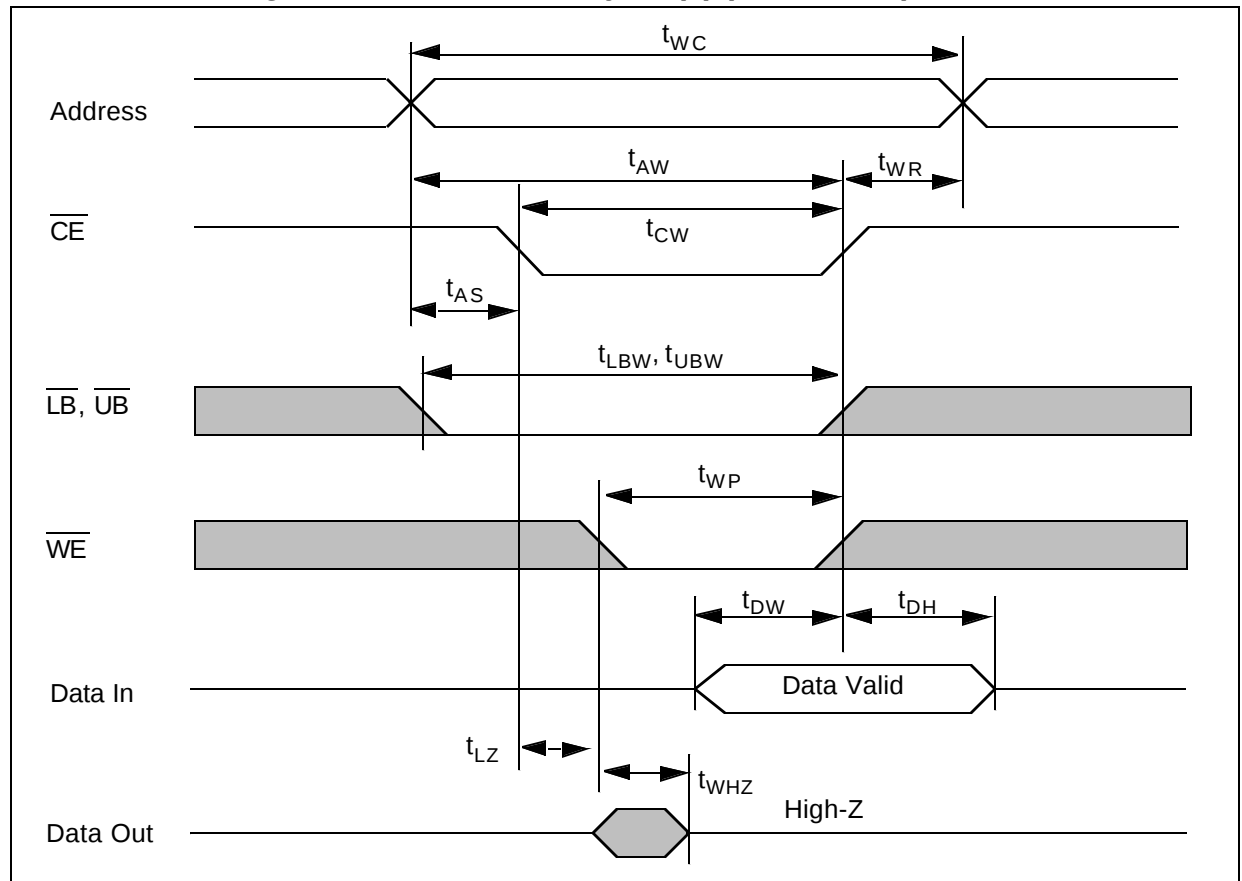
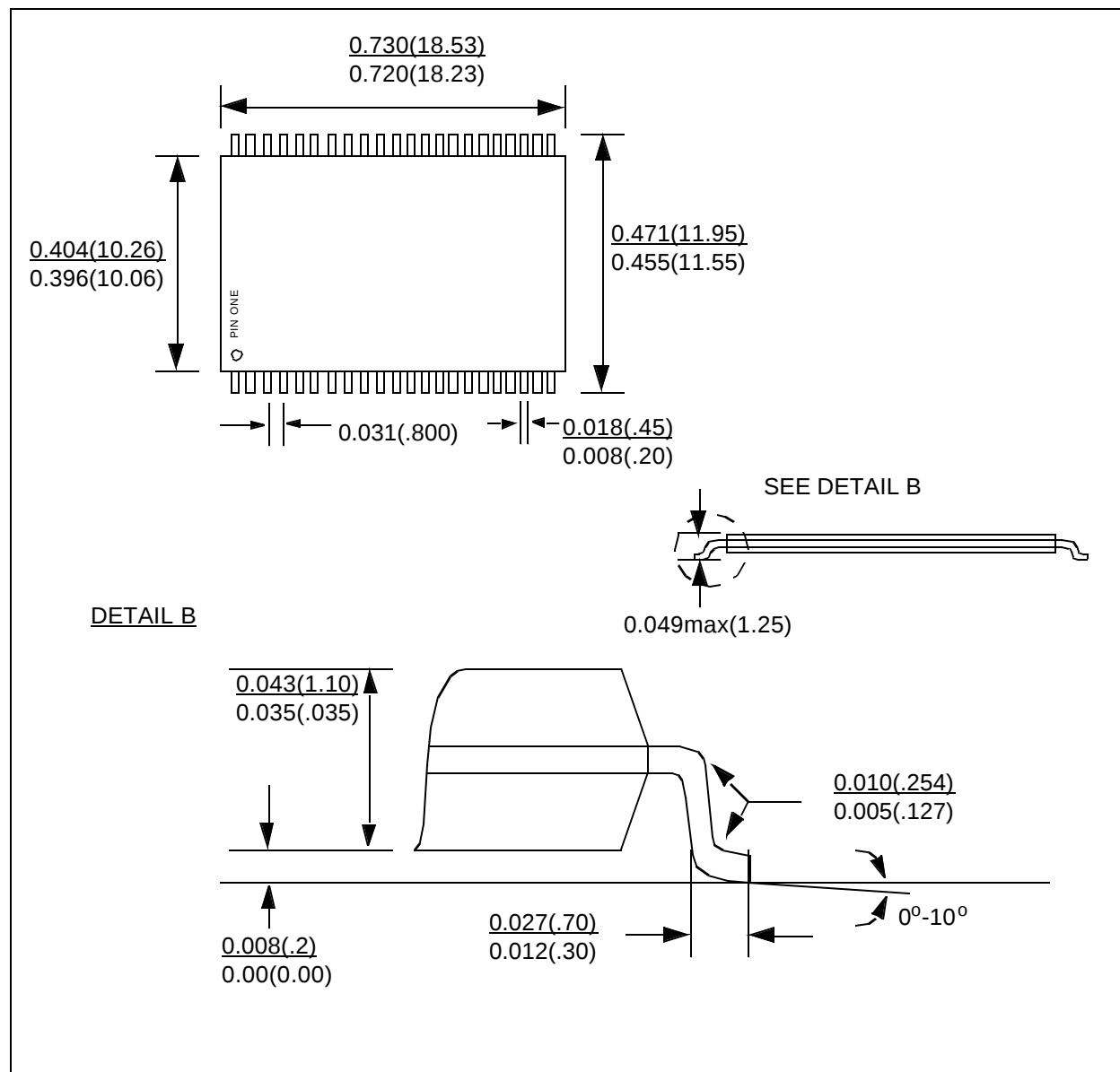


FIGURE 8: 44-LEAD TSOP PACKAGE (T44)**Note:**

1. ALL DIMENSIONS IN INCHES (MILLIMETERS)
2. PACKAGE DIMENSIONS EXCLUDE MOLDING FLASH

FIGURE 9: BALL GRID ARRAY PACKAGING

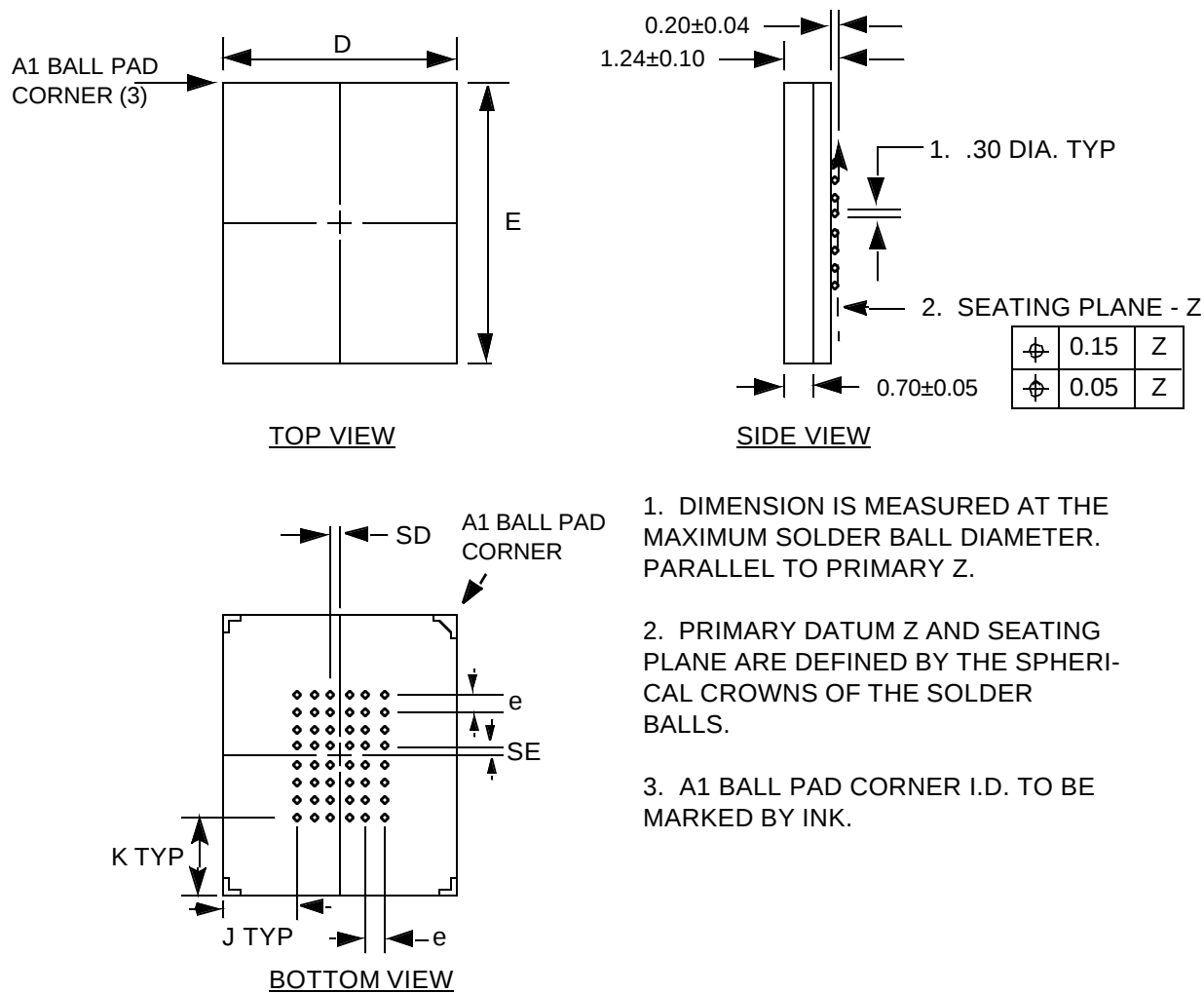


TABLE 8: Dimensions (mm)

D	E	e = 0.75				BALL MATRIX TYPE
		SD	SE	J	K	
6	8	0.375	0.375	1.125	2.375	FULL

TABLE 9: Ordering Information

Part Number*	Package	Temperature Range	Voltage Range	Speed
EM064L16B	48 pin BGA	-40 to +85°C	2.3 to 3.6 V	55 ns @ 2.7V
EM064L16T	44 pin TSOP	-40 to +85°C	2.3 to 3.6 V	55 ns @ 2.7V

* This part number must appear on your order.

TABLE 10: Revision History

Revision #	Date	Change Description
A	Jan. 2000	Initial Advance Release
B	Apr. 2001	Access time 55ns @ 3.0V, corrected voltage range, TSOP mechanical package drawing, misc. errata

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