



## 128K × 8 CMOS STATIC RAM

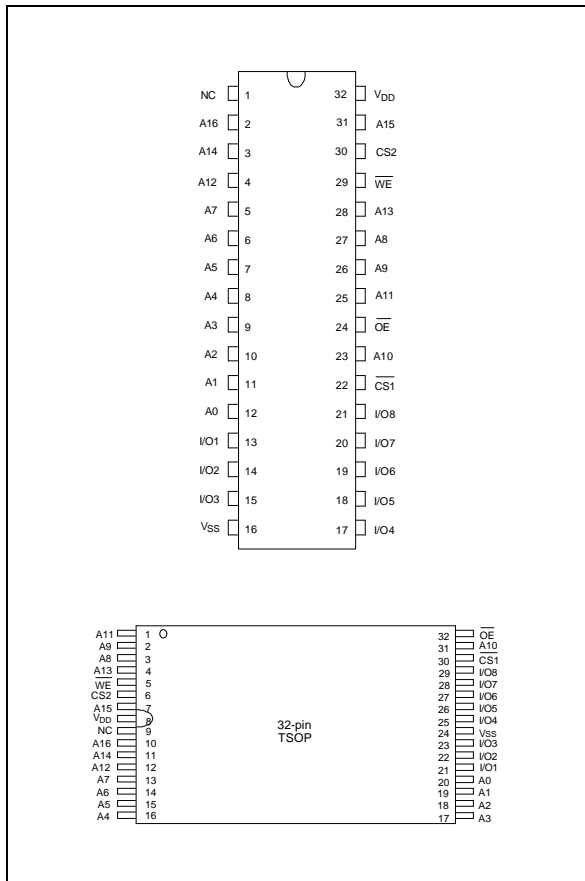
### GENERAL DESCRIPTION

The W24010 is a normal-speed, very low-power CMOS static RAM organized as 131072 × 8 bits that operates on a wide voltage range from 2.7V to 5.5V power supply. The W24010 family, W24010-70LE and W24010-70LI, can meet the requirement of various operating temperature. This device is manufactured using Winbond's high performance CMOS technology.

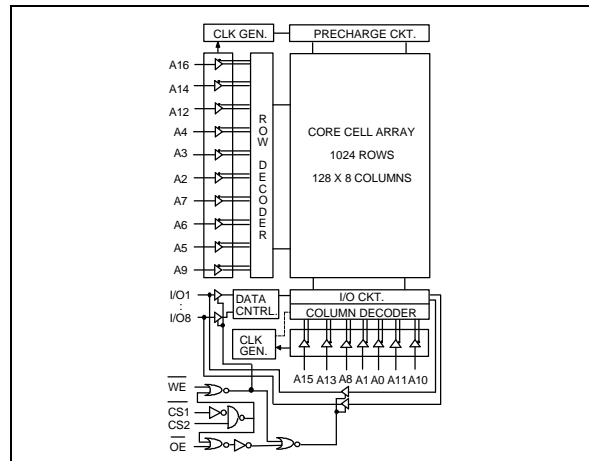
### FEATURES

- Low power consumption:
  - Active: 350 mW (max.)
  - Standby: 15 μW (max.) /3V  
50 μW (max.) /5V
- Access time: 70 nS (max.) /5V  
100 nS (max.) /3V
- Single 3V/5V power supply
- Fully static operation
- All inputs and outputs directly TTL compatible
- Three-state outputs
- Battery back-up operation capability
- Data retention voltage: 2V (min.)
- Packaged in 32-pin 600 mil DIP, 450 mil SOP, standard type one TSOP (8 mm × 20 mm) and small type one TSOP (8 mm × 13.4 mm)

### PIN CONFIGURATIONS



### BLOCK DIAGRAM



### PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0–A16	Address Inputs
I/O1–I/O8	Data Inputs/Outputs
CS1, CS2	Chip Select Input
WE	Write Enable Input
OE	Output Enable Input
VDD	Power Supply
VSS	Ground
NC	No Connection

## TRUTH TABLE

CS1	CS2	OE	WE	MODE	I/O1 - I/O8	V <sub>DD</sub> CURRENT
H	X	X	X	Not Selected	High Z	ISB, ISB1
X	L	X	X	Not Selected	High Z	ISB, ISB1
L	H	H	H	Output Disable	High Z	I <sub>DD</sub>
L	H	L	H	Read	Data Out	I <sub>DD</sub>
L	H	X	L	Write	Data In	I <sub>DD</sub>

## DC CHARACTERISTICS

### Absolute Maximum Ratings

PARAMETER	RATING	UNIT
Supply Voltage to V <sub>SS</sub> Potential	-0.5 to +7.0	V
Input/Output to V <sub>SS</sub> Potential	-0.5 to V <sub>DD</sub> +0.5	V
Allowable Power Dissipation	1.0	W
Storage Temperature	-65 to +150	°C
Operating Temperature	LE	-20 to 85
	LI	-40 to 85

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

### Operating Characteristics

(V<sub>DD</sub> = 5V ±10%; V<sub>DD</sub> = 3V ±10%; V<sub>SS</sub> = 0V; T<sub>A</sub> (°C) = -20 to 85 for LE, -40 to 85 for LI)

PARAMETER	SYM.	TEST CONDITIONS	5V			3V			UNIT
			MIN.	TYP.*	MAX.	MIN.	TYP.*	MAX.	
Input Low Voltage	V <sub>IL</sub>	-	-0.5	-	+0.8	-0.5	-	+0.6	V
Input High Voltage	V <sub>IH</sub>	-	+2.2	-	V <sub>DD</sub> +0.5	+2.0	-	V <sub>DD</sub> +0.5	V
Input Leakage Current	I <sub>LI</sub>	V <sub>IN</sub> = V <sub>SS</sub> to V <sub>DD</sub>	-1	-	+1	-1	-	+1	μA
Output Leakage Current	I <sub>LO</sub>	V <sub>I/O</sub> = V <sub>SS</sub> to V <sub>DD</sub> , CS1 = V <sub>IH</sub> (min.) or CS2 = V <sub>IL</sub> (max.) or OE = V <sub>IH</sub> (min.) or WE = V <sub>IL</sub> (max.)	-1	-	+1	-1	-	+1	μA
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = +2.1 mA	-	-	0.4	-	-	0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1.0 mA	2.4	-	-	2.2	-	-	V

Operating Characteristics, continued

PARAMETER	SYM.	TEST CONDITIONS	5V			3V			UNIT
			MIN.	TYP.*	MAX.	MIN.	TYP.*	MAX.	
Operating Power Supply Current	I <sub>DD</sub>	CS1 = V <sub>IL</sub> (max.) and CS2 = V <sub>IH</sub> (min.) I/O = 0 mA Cycle = min. Duty = 100%	-	-	70	-	-	30	mA
Standby Power Supply Current	ISB	CS1 = V <sub>IH</sub> (min.) or CS2 = V <sub>IL</sub> (max.) Cycle = min. Duty = 100%	-	-	3	-	-	1	mA
	ISB1	CS1 ≥ V <sub>DD</sub> - 0.2V or CS2 ≤ 0.2V	-	1.0	10	-	0.5	5	μA

Note: Typical parameter is measured under ambient temperature T<sub>A</sub> = 25° C and V<sub>DD</sub> = 5V/ 3V

## CAPACITANCE

(V<sub>DD</sub> = 5 V, T<sub>A</sub> = 25° C, f = 1 MHz)

PARAMETER	SYM.	CONDITIONS	MAX.	UNIT
Input Capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 0V	6	pF
Input/Output Capacitance	C <sub>I/O</sub>	V <sub>OUT</sub> = 0V	8	pF

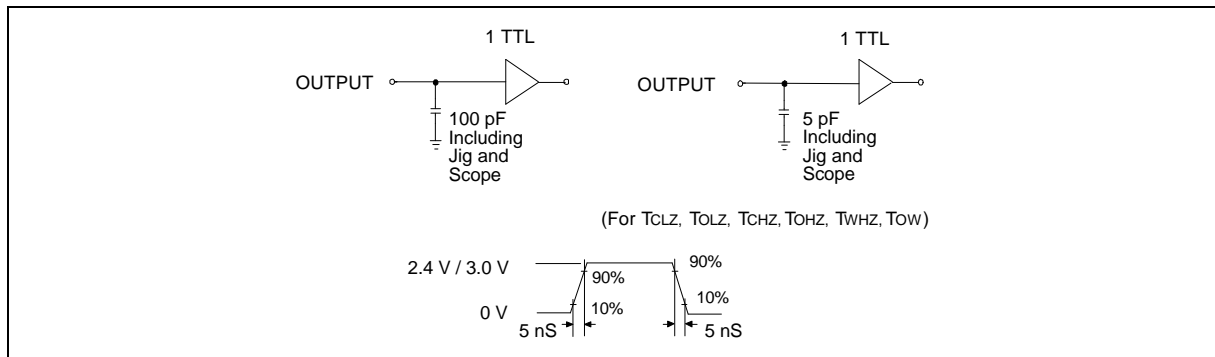
Note: These parameters are sampled but not 100% tested.

## AC Characteristics

### AC Test Conditions

PARAMETER	CONDITIONS
Input Pulse Levels	3V 0V to 2.4V
	5V 0V to 3.0V
Input Rise and Fall Times	5 nS
Input and Output Timing Reference Level	1.5V
Output Load	See the drawing below

### AC Test Loads and Waveform





AC Characteristics, continued

(V<sub>DD</sub> = 5 V ±10%; V<sub>DD</sub> = 3 V ±10%; V<sub>SS</sub> = 0 V; T<sub>A</sub> (°C) = -20 to 85 for LE, -40 to 85 for LI)**Read Cycle**

PARAMETER	SYM.	5 V		3 V		UNIT
		MIN.	MAX.	MIN.	MAX.	
Read Cycle Time	T <sub>RC</sub>	70	-	100	-	nS
Address Access Time	T <sub>AA</sub>	-	70	-	100	nS
Chip Select Access Time	T <sub>ACS</sub>	-	70	-	100	nS
Output Enable to Output Valid	T <sub>AOE</sub>	-	35	-	50	nS
Chip Selection to Output in Low Z	T <sub>CLZ</sub> *	10	-	15	-	nS
Output Enable to Output in Low Z	T <sub>OLZ</sub> *	5	-	5	-	nS
Chip Deselection to Output in High Z	T <sub>CHZ</sub> *	-	30	-	35	nS
Output Disable to Output in High Z	T <sub>OHZ</sub> *	-	30	-	35	nS
Output Hold from Address Change	T <sub>OH</sub>	10	-	15	-	nS

\* These parameters are sampled but not 100% tested

**Write Cycle**

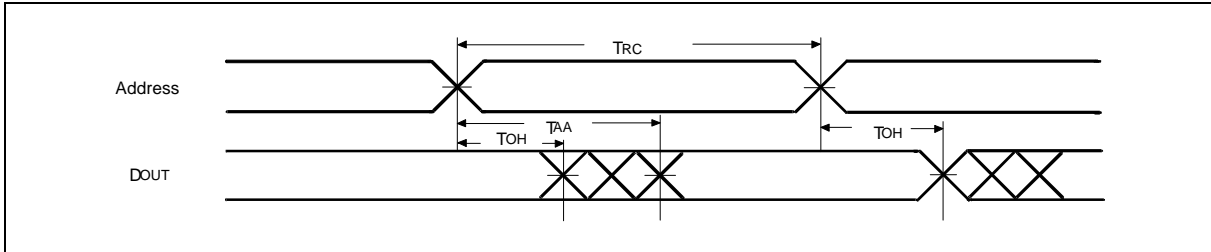
PARAMETER	SYM.	5 V		3 V		UNIT
		MIN.	MAX.	MIN.	MAX.	
Write Cycle Time	T <sub>WC</sub>	70	-	100	-	nS
Chip Selection to End of Write	T <sub>CW</sub>	50	-	70	-	nS
Address Valid to End of Write	T <sub>AW</sub>	50	-	70	-	nS
Address Setup Time	T <sub>AS</sub>	0	-	0	-	nS
Write Pulse Width	T <sub>WP</sub>	50	-	70	-	nS
Write Recovery Time	$\overline{CS1}, CS2, \overline{WE}$ T <sub>WR</sub>	0	-	0	-	nS
Data Valid to End of Write	T <sub>DW</sub>	30	-	50	-	nS
Data Hold from End of Write	T <sub>DH</sub>	0	-	0	-	nS
Write to Output in High Z	T <sub>WHZ</sub> *	-	25	-	30	nS
Output Disable to Output in High Z	T <sub>OHZ</sub> *	-	25	-	30	nS
Output Active from End of Write	T <sub>OW</sub>	5	-	10	-	nS

\* These parameters are sampled but not 100% tested

**TIMING WAVEFORMS**

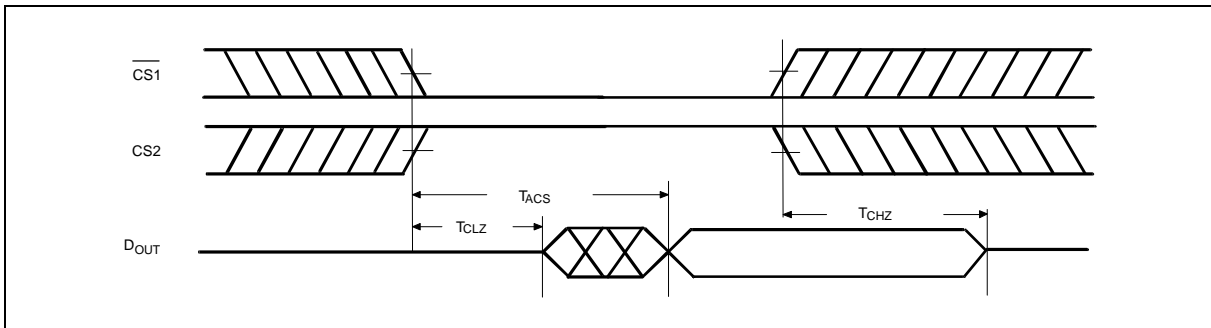
**Read Cycle 1**

(Address Controlled)



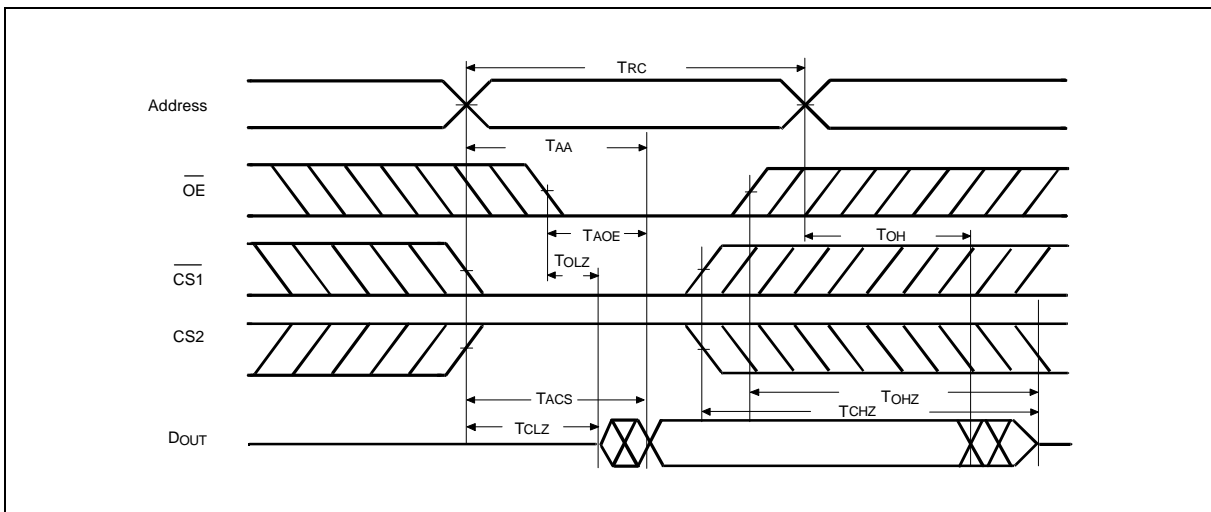
**Read Cycle 2**

(Chip Select Controlled)



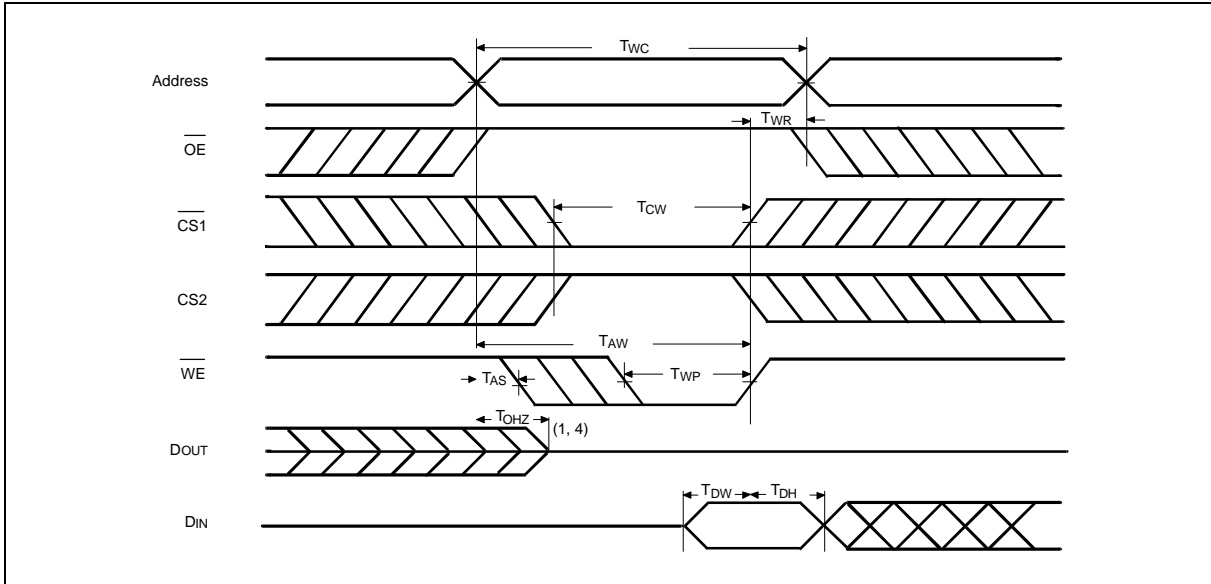
**Read Cycle 3**

(Output Enable Controlled)



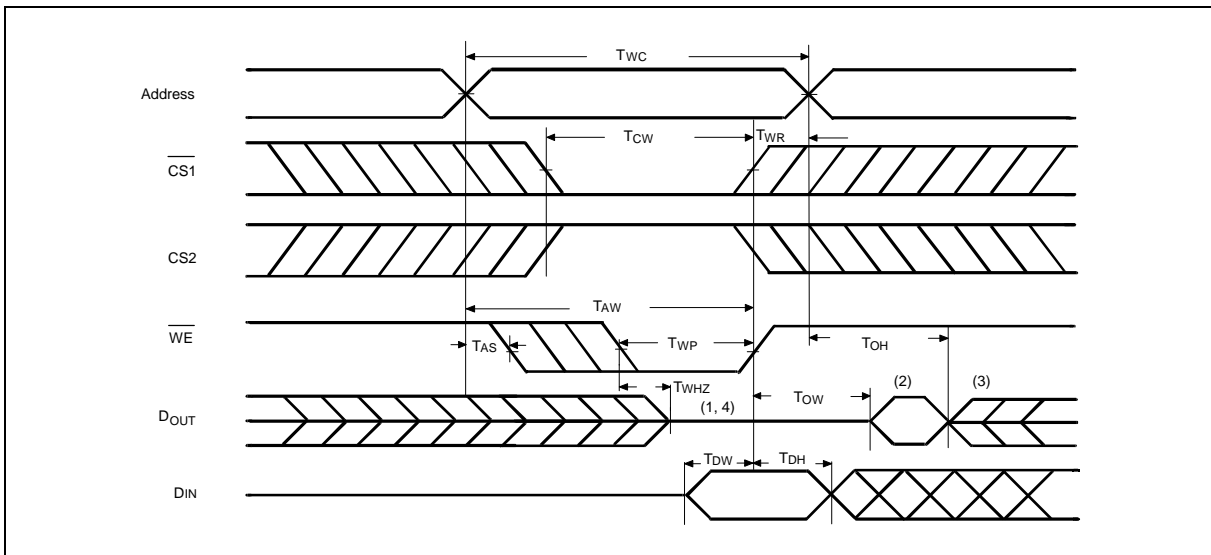
Timing Waveforms, continued

**Write Cycle 1**



**Write Cycle 2**

( $\overline{OE} = V_{IL}$  Fixed)



Notes:

1. During this period, I/O pins are in the output state, so input signals of opposite phase to the outputs should not be applied.
2. The data output from DOUT are the same as the data written to DIN during the write cycle.
3. DOUT provides the read data for the next address.
4. Transition is measured  $\pm 500$  mV from steady state with  $C_L = 5$  pF. This parameter is guaranteed but not 100% tested.

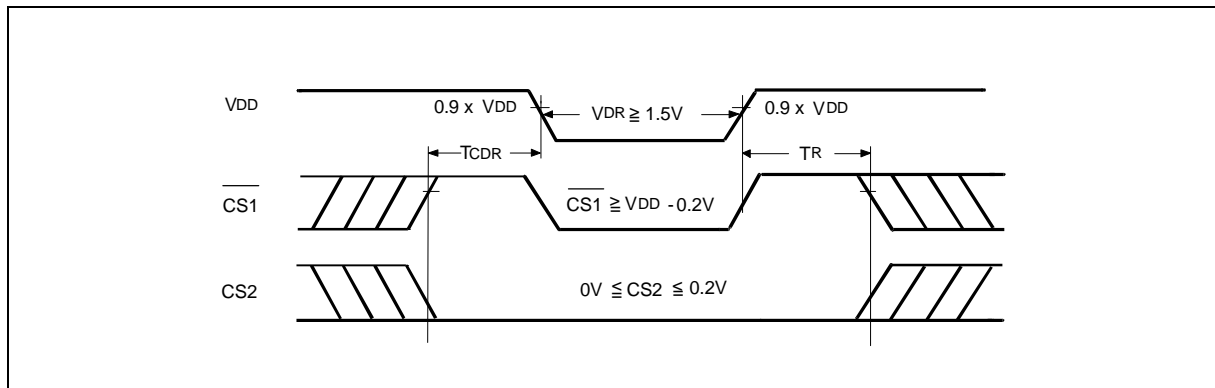
**DATA RETENTION CHARACTERISTICS**

(TA (°C) = -20 to 85 for LE; -40 to 85 for LI)

PARAMETER	SYM.	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
VDD for Data Retention	VDR	$\overline{CS1} \geq V_{DD} - 0.2V$ or $CS2 \leq 0.2V$	2.0	-	-	V
Data Retention Current	I <sub>DDDR</sub>	$\overline{CS1} \geq V_{DD} - 0.2V$ or $CS2 \leq 0.2V, V_{DD} = 3V$	-	-	5	μA
Chip Deselect to Data Retention Time	T <sub>CDR</sub>	See data retention waveform	0	-	-	nS
Operation Recovery Time	T <sub>R</sub>		T <sub>RC</sub> *	-	-	nS

\* Read Cycle Time

**DATA RETENTION WAVEFORM**





## ORDERING INFORMATION

PART NO.	ACCESS TIME (nS)	OPERATING VOLTAGE (V)	OPERATING TEMPERATURE (°C)	PACKAGE
W24010-70LE	70/100	5V/3V	-20 to 85	600 mil DIP
W24010S-70LE	70/100	5V/3V	-20 to 85	450 mil SOP
W24010T-70LE	70/100	5V/3V	-20 to 85	Standard type one TSOP
W24010Q-70LE	70/100	5V/3V	-20 to 85	Small type one TSOP
W24010-70LI	70/100	5V/3V	-40 to 85	600 mil DIP
W24010S-70LI	70/100	5V/3V	-40 to 85	450 mil SOP
W24010T-70LI	70/100	5V/3V	-40 to 85	Standard type one TSOP
W24010Q-70LI	70/100	5V/3V	-40 to 85	Small type one TSOP

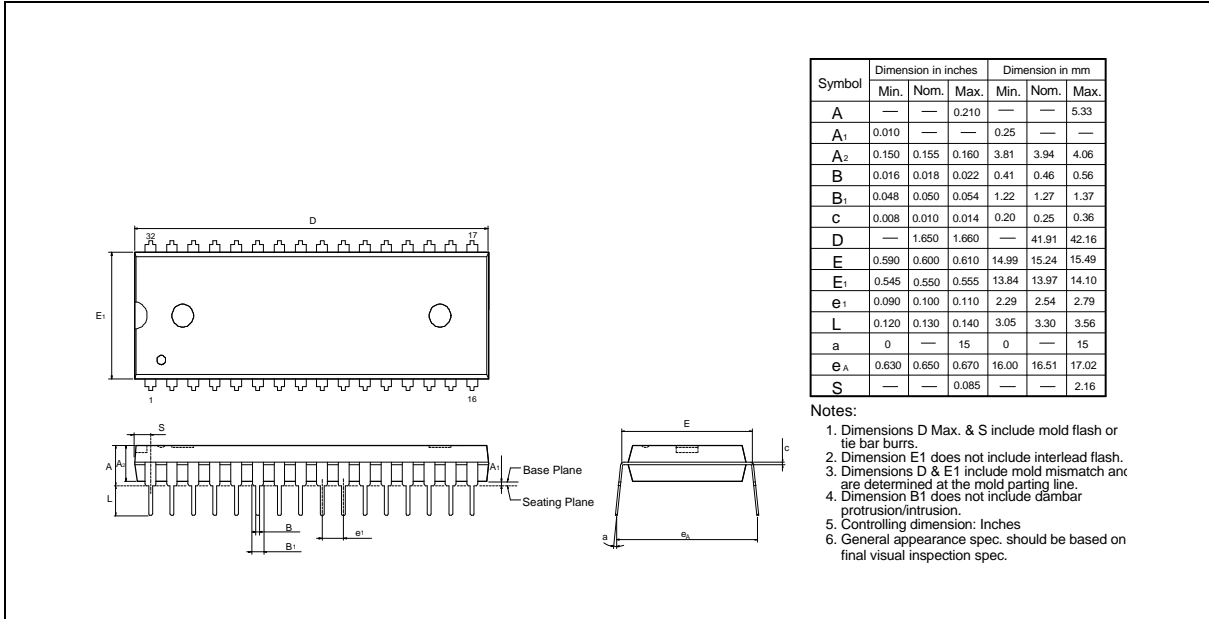
### Notes:

1. Winbond reserves the right to make changes to its products without prior notice.
2. Purchasers are responsible for performing appropriate quality assurance testing on products intended for use in applications where personal injury might occur as a consequence of product failure.

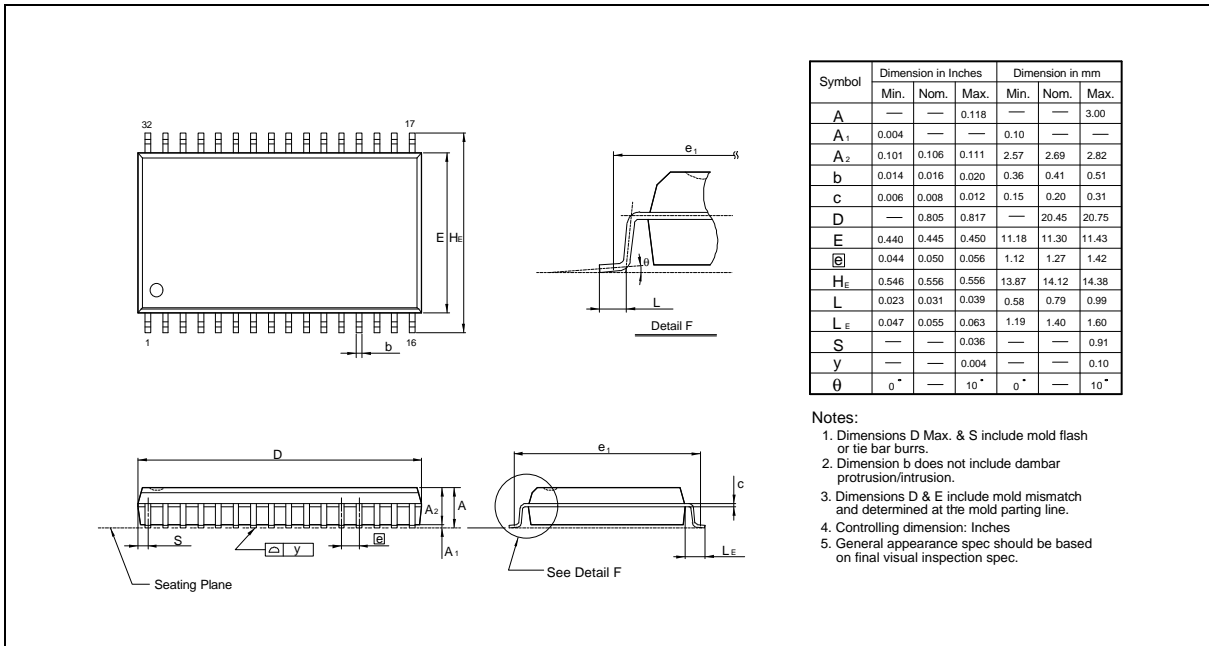


## PACKAGE DIMENSIONS

### 32-pin P-DIP

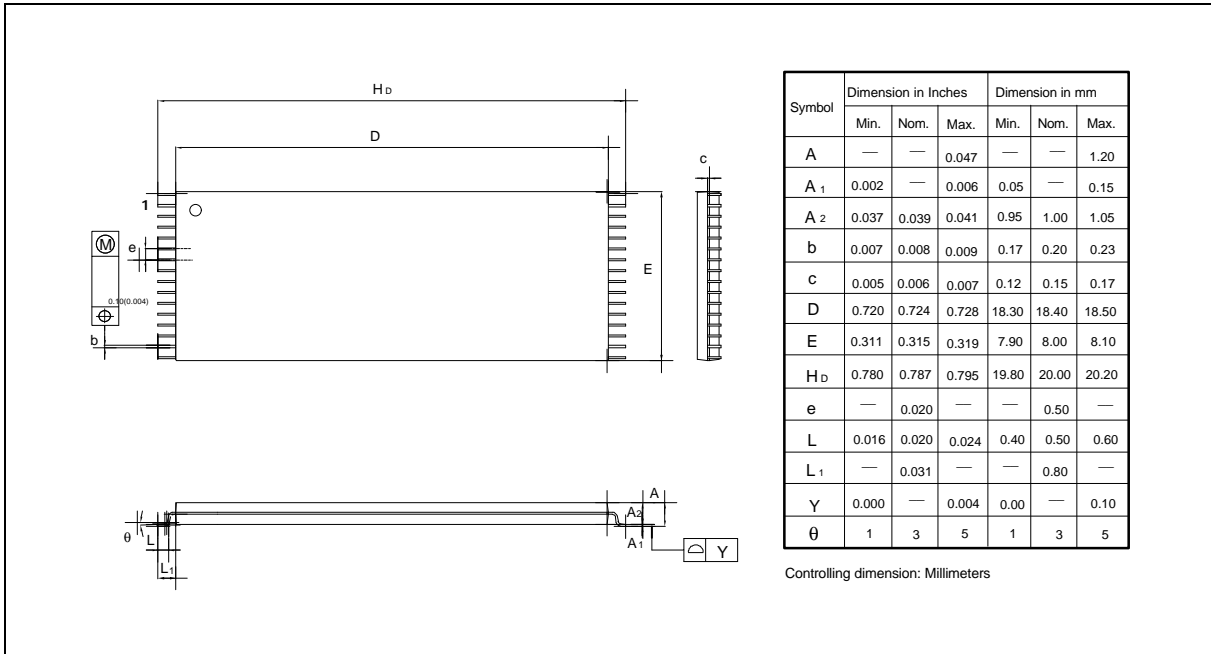


### 32-pin SOP Wide Body

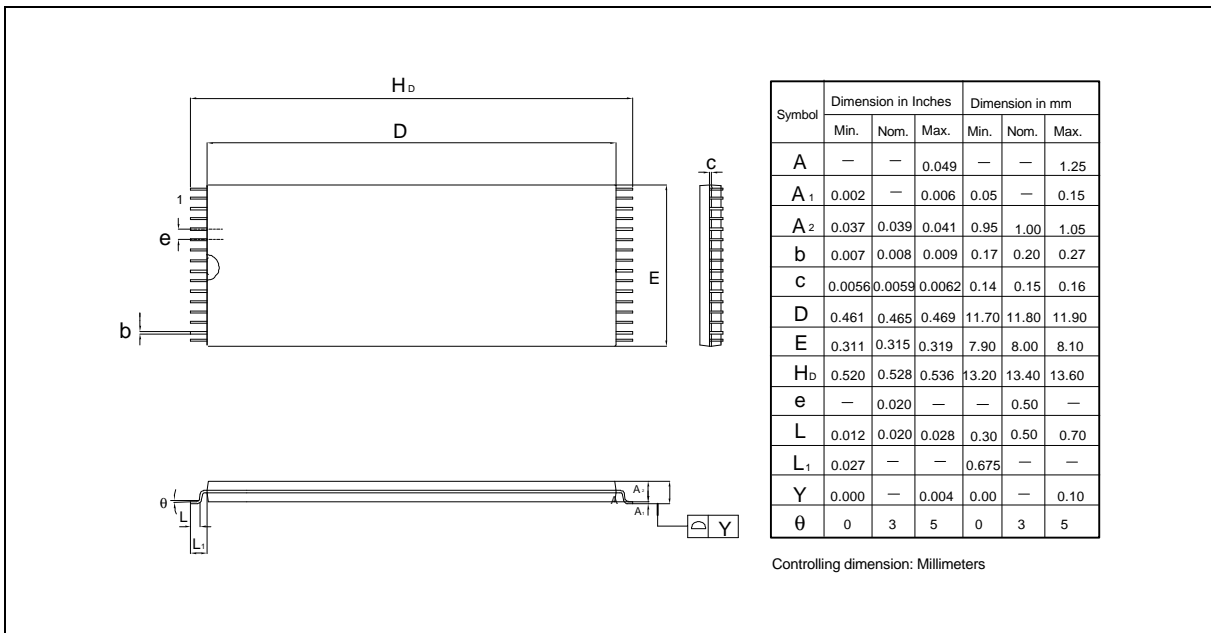


Package Dimensions, continued

### 32-pin Standard Type One TSOP



### 32-pin Small Type One TSOP





## VERSION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
A1	Jun. 1996	-	Initial Issued
A2	Dec. 1996	-	NA
A3	Feb. 1998	1, 2, 4, 7, 8	Delete operating temperature (SL = 0 to 70 °C)
A4	Apr. 1998	3	Add standby power supply current (I <sub>SB1</sub> ) typical parameter when operation temperature TA = 25° C
A5	Jun. 1998	2, 3	Correct Operating Characteristics: add $\overline{CS1}$ , CS2 test conditions
		7	Correct data retention characteristics: add $\overline{CS1}$ , CS2 test conditions
A6	Nov. 1998	1, 8, 10, 11	Deduct reverse type one TSOP package



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Note: All data and specifications are subject to change without notice.

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