



## 32K × 8 CMOS STATIC RAM

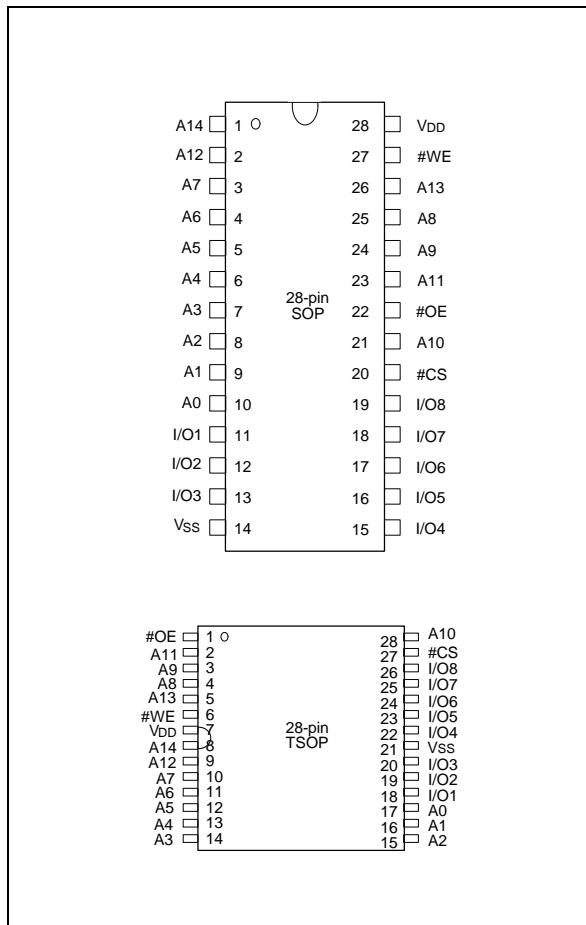
### GENERAL DESCRIPTION

The W24LH8 is a normal speed, very low power CMOS static RAM organized as 32768 × 8 bits that operates on a wide voltage range from 2.7V to 5.5V power supply. The W24LH8 family, W24LH8-55LE and W24LH8-55LI, can meet requirement of various operating temperature. This device is manufactured using Winbond's high performance CMOS technology.

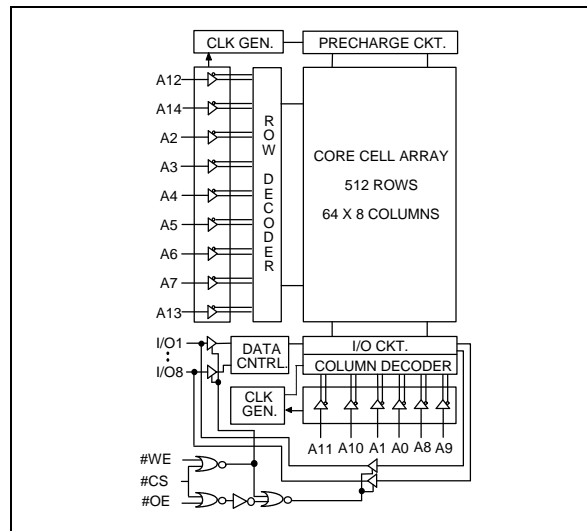
### FEATURES

- Low power consumption
- Access time: 55 nS (5V ±10%),  
100 nS (3V ±10%)
- 2.7V to 5.5V supply voltage
- Fully static operation
- All inputs and outputs directly TTL compatible
- Three-state outputs
- Battery back-up operation capability
- Data retention voltage: 2V (min.)
- Available packages: 330 mil SOP and standard type one TSOP (8 mm × 13.4 mm)

### PIN CONFIGURATIONS



### BLOCK DIAGRAM



### PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0–A14	Address Inputs
I/O1–I/O8	Data Inputs/Outputs
#CS	Chip Select Input
#WE	Write Enable Input
#OE	Output Enable Input
VDD	Power Supply
VSS	Ground

## TRUTH TABLE

#CS	#OE	#WE	MODE	I/O1 - I/O8	V <sub>DD</sub> CURRENT
H	X	X	Not Selected	High Z	ISB, ISB1
L	H	H	Output Disable	High Z	I <sub>DD</sub>
L	L	H	Read	Data Out	I <sub>DD</sub>
L	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	°C
	LI	-40 to 85	°C

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>SS</sub> = 0V; T<sub>A</sub> (°C) = -20 to 85 for LE; -40 to 85 for LI)

PARAMETER	SYM.	TEST CONDITIONS	MIN.	MAX.	UNIT
Input Low Voltage	V <sub>IL</sub>	-	-0.5	+0.6	V
Input High Voltage	V <sub>IH</sub>	-	+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	μA
Output Leakage Current	I <sub>LO</sub>	V <sub>I/O</sub> = V <sub>SS</sub> to V <sub>DD</sub> , #CS = V <sub>IH</sub> (min.) or #OE = V <sub>IH</sub> (min.) or #WE = V <sub>IL</sub> (max.)	-1	+1	μA
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = +2.1 mA	-	0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1.0 mA	2.2	-	V



Operating Characteristics, continued

PARAMETER	SYM.	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Operating Power Supply Current	IDD	#CS = VIL (max.), I/O = 0 mA, Cycle = min. Duty = 100%	5V	-	-	70	mA
			3V	-	-	40	
Standby Power Supply Current	ISB	#CS = VIH (min.), Cycle = min. Duty = 100%	-	-	1	mA	
	ISB1	#CS ≥ VDD - 0.2V	-	0.5	5		μA

Note: Typical parameter is measured under ambient temperature TA = 25° C and VDD = 5V/ 3V.

## CAPACITANCE

(TA = 25° C, f = 1 MHz)

PARAMETER	SYM.	CONDITIONS	MAX.	UNIT
Input Capacitance	CIN	VIN = 0V	6	pF
Input/Output Capacitance	CIO	VOUT = 0V	8	pF

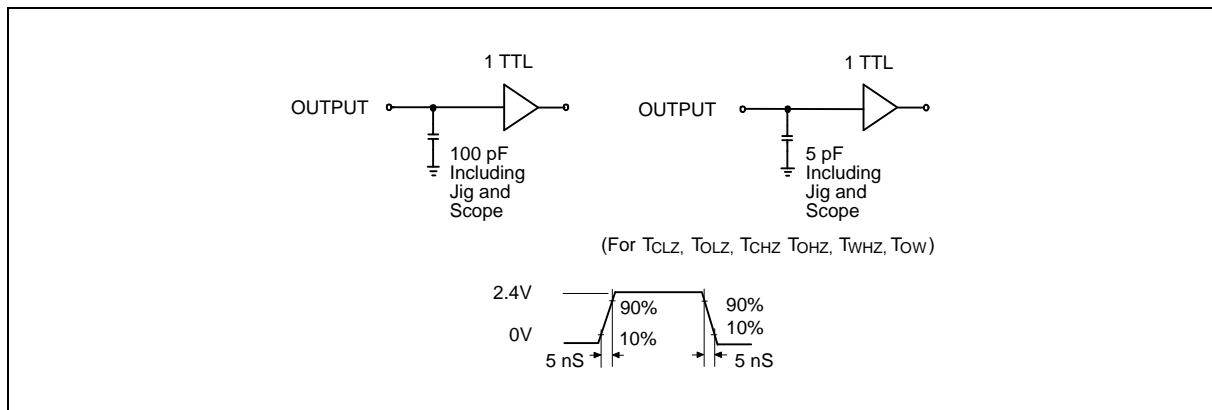
Note: These parameters are sampled but not 100% tested.

## AC CHARACTERISTICS

### AC Test Conditions

PARAMETER	CONDITIONS
Input Pulse Levels	0V to 2.4V
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>SS</sub> = 0V; T<sub>A</sub> (°C) = -20 to 85 for LE; -40 to 85 for LI)**Read Cycle**

PARAMETER	SYMBOL	3V ±10%		5V ±10%		UNIT
		MIN.	MAX.	MIN.	MAX.	
Read Cycle Time	TRC	100	-	55	-	nS
Address Access Time	TAA	-	100	-	55	nS
Chip Select Access Time	TACS	-	100	-	55	nS
Output Enable to Output Valid	TAOE	-	50	-	30	nS
Chip Selection to Output in Low Z	TCLZ*	15	-	10	-	nS
Output Enable to Output in Low Z	TOLZ*	5	-	5	-	nS
Chip Deselection to Output in High Z	TCHZ*	-	35	-	20	nS
Output Disable to Output in High Z	TOHZ*	-	35	-	20	nS
Output Hold from Address Change	TOH	15	-	10	-	nS

\* These parameters are sampled but not 100% tested

**Write Cycle**

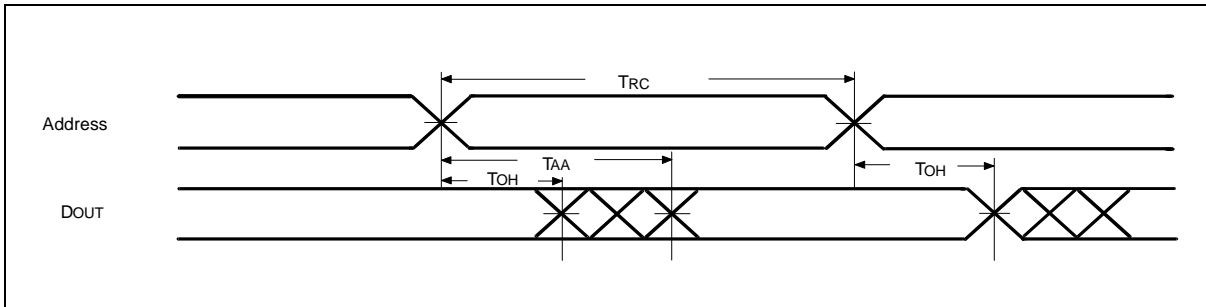
PARAMETER	SYMBOL	3V ±10%		5V ±10%		UNIT	
		MIN.	MAX.	MIN.	MAX.		
Write Cycle Time	TWC	100	-	55	-	nS	
Chip Selection to End of Write	TCW	80	-	40	-	nS	
Address Valid to End of Write	TAW	80	-	40	-	nS	
Address Setup Time	TAS	0	-	0	-	nS	
Write Pulse Width	TWP	70	-	30	-	nS	
Write Recovery Time	#CS, #WE	TWR	0	-	0	-	nS
Data Valid to End of Write	TDW	40	-	25	-	nS	
Data Hold from End of Write	TDH	0	-	0	-	nS	
Write to Output in High Z	TWHZ*	-	35	-	20	nS	
Output Disable to Output in High Z	TOHZ*	-	35	-	20	nS	
Output Active from End of Write	TOW	5	-	5	-	nS	

\* These parameters are sampled but not 100% tested

**TIMING WAVEFORMS**

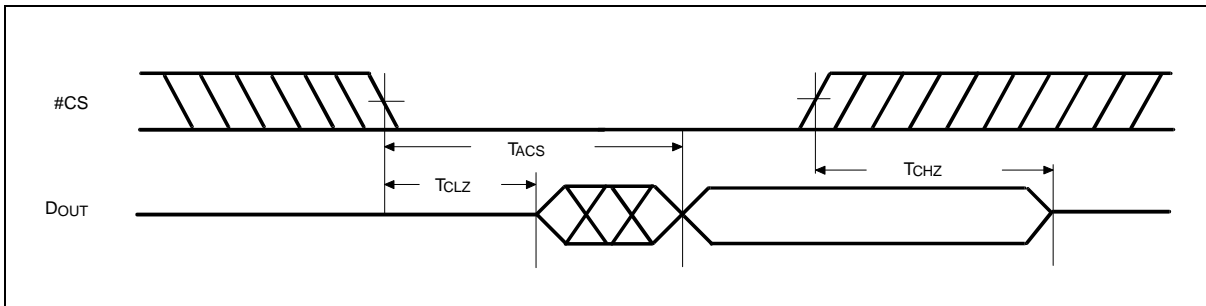
**Read Cycle 1**

(Address Controlled)



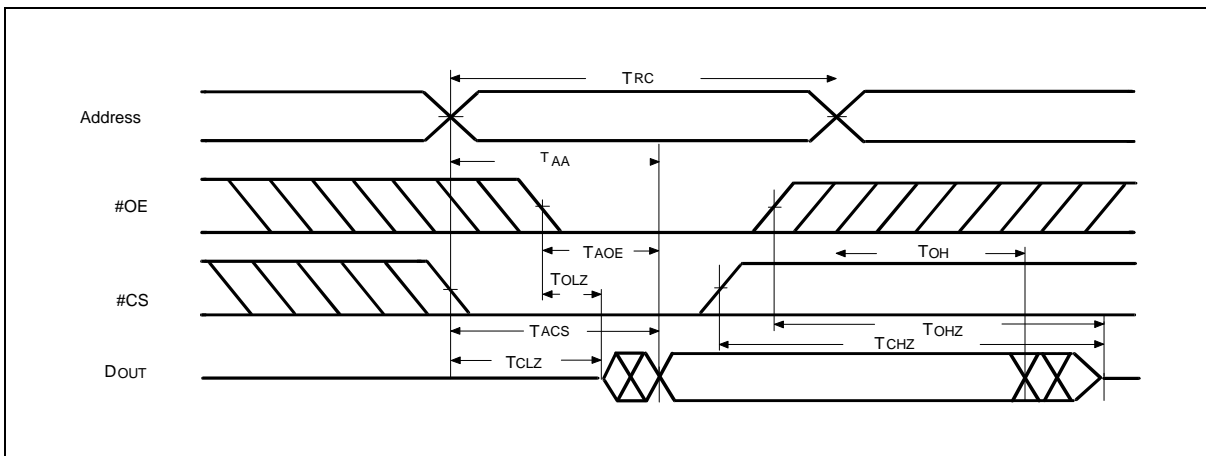
**Read Cycle 2**

(Chip Select Controlled)



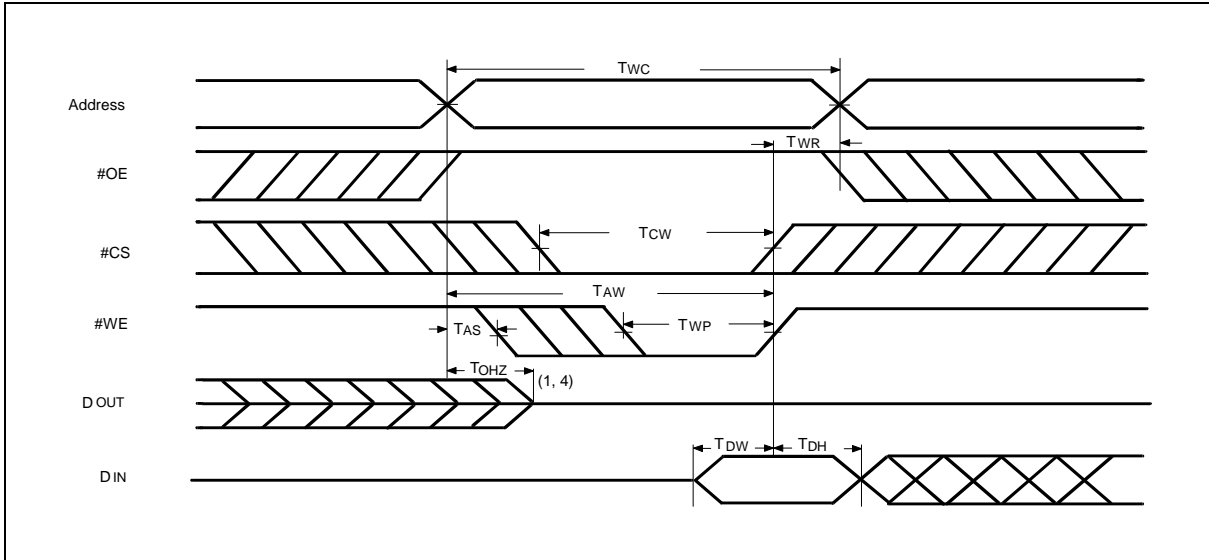
**Read Cycle 3**

(Output Enable Controlled)



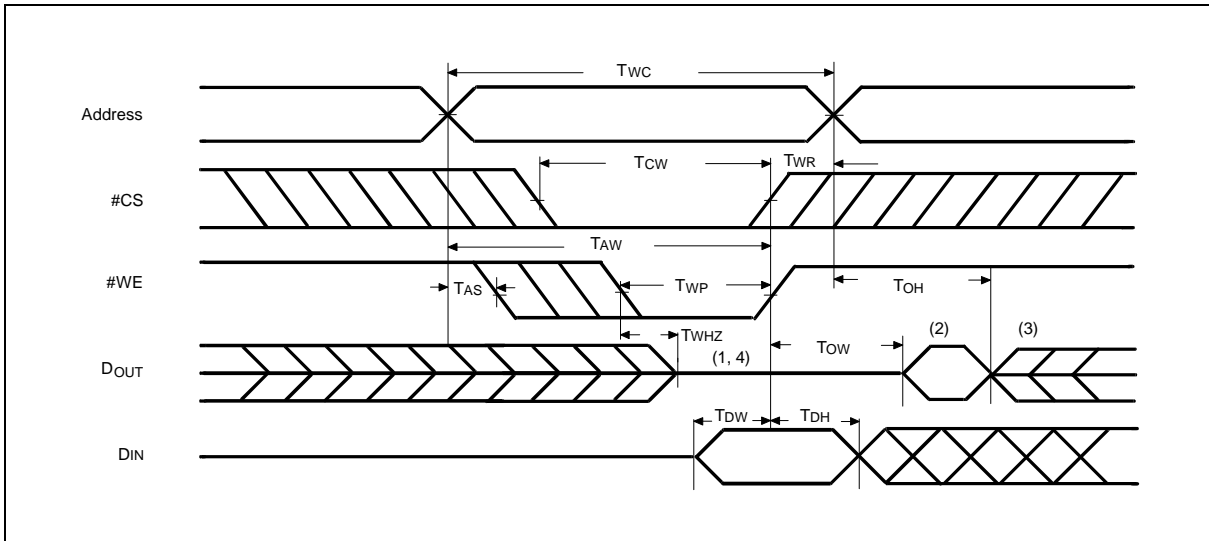
Timing Waveforms, continued

## Write Cycle 1



## Write Cycle 2

(#OE = VIL 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.



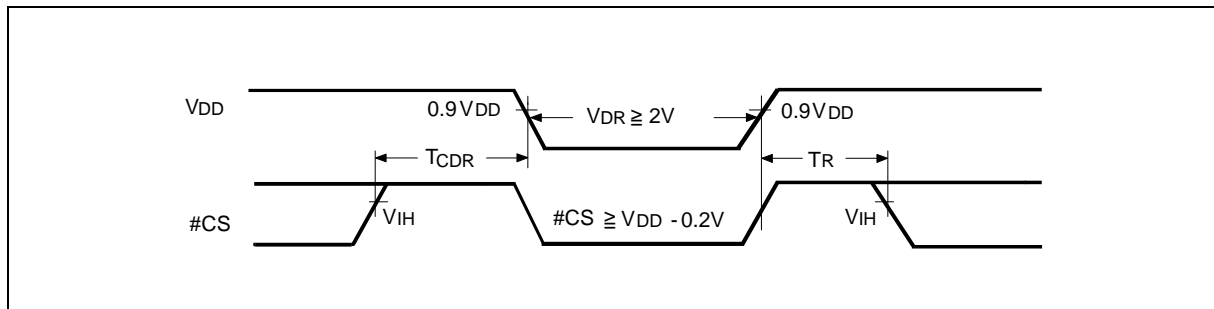
## DATA RETENTION CHARACTERISTICS

(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	#CS ≥ VDD - 0.2V	2.0	-	-	V
Data Retention Current	I <sub>DDDR</sub>	#CS ≥ VDD - 0.2V, VDD = 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
W24LH8S-55LE	55	4.5V to 5.5V	-20 to 85	330 mil SOP
	100	2.7V to 3.3V	-20 to 85	
W24LH8Q-55LE	55	4.5V to 5.5V	-20 to 85	Standard type one TSOP
	100	2.7V to 3.3V	-20 to 85	
W24LH8S-55LI	55	4.5V to 5.5V	-40 to 85	330 mil SOP
	100	2.7V to 3.3V	-40 to 85	
W24LH8Q-55LI	55	4.5V to 5.5V	-40 to 85	Standard type one TSOP
	100	2.7V to 3.3V	-40 to 85	

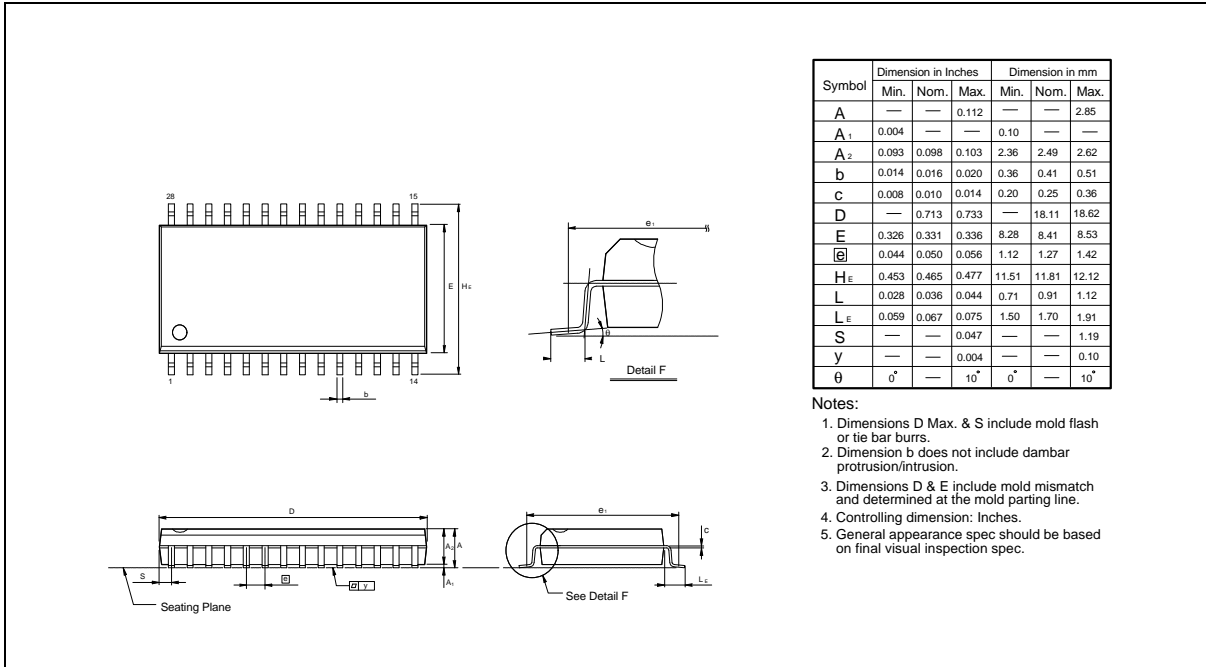
Notes:

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.

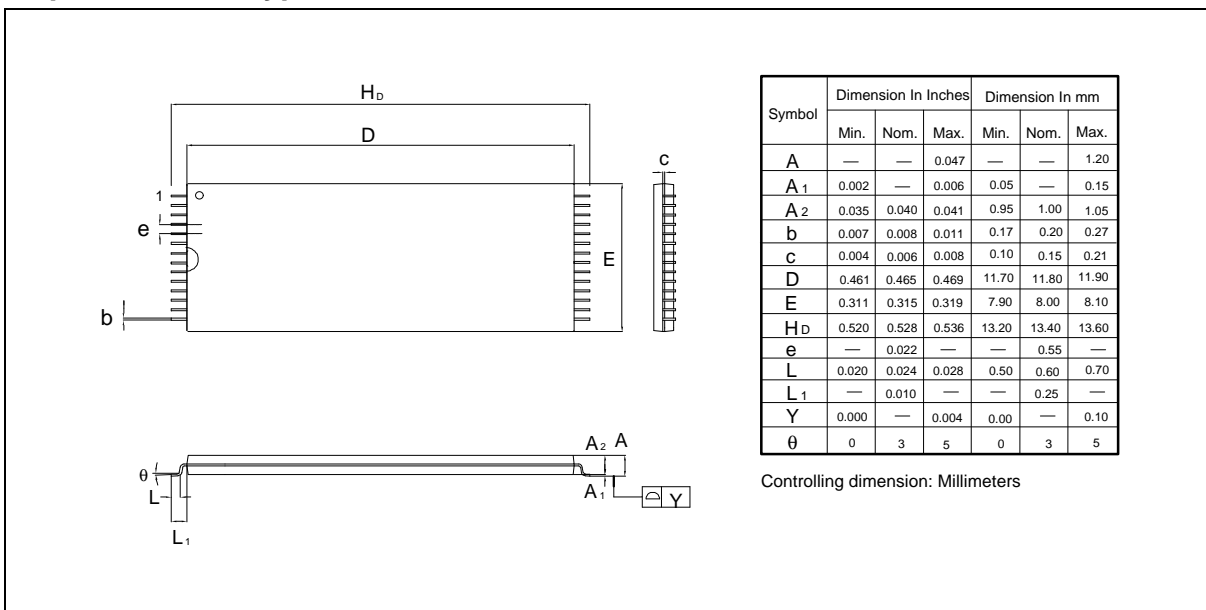


## PACKAGE DIMENSIONS

### 28-pin SOP Wide Body



### 28-pin Standard Type One TSOP





## VERSION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
A1	Nov. 1998	-	Initial Issued
A2	Jan. 1999	1	Change low power consumption active: from 108 to 156 mW (max.)
		3	Change operating power supply current (IDD) from 30 to 40 mA (max.)
A3	Mar. 2001	1	Change operating power supply voltage from (2.7V to 3.6V) to (2.7V to 5.5V), access time from 70 nS to (55 nS (5V $\pm$ 10%), 100 nS (3V $\pm$ 10%)), and remove 28-pin 600 mil DIP package.
		3	Change operating power supply current (IDD) from 40 mA to (70 mA/5V, 40 mA/3V)(max.)
		4	Add 55 nS (5V $\pm$ 10%) spec. and change 3V $\pm$ 10% spec. from 70 nS to 100 nS.
		2, 4, 7, 8	Delete SL grade
		8	Correct Ordering Information

**Headquarters**

No. 4, Creation Rd. III,  
Science-Based Industrial Park,  
Hsinchu, Taiwan  
TEL: 886-3-5770066  
FAX: 886-3-5792766  
<http://www.winbond.com.tw/>  
Voice & Fax-on-demand: 886-2-27197006

**Taipei Office**

11F, No. 115, Sec. 3, Min-Sheng East Rd.,  
Taipei, Taiwan  
TEL: 886-2-27190505  
FAX: 886-2-27197502

**Winbond Electronics (H.K.) Ltd.**

Unit 9-15, 22F, Millennium City,  
No. 378 Kwun Tong Rd;  
Kowloon, Hong Kong  
TEL: 852-27513100  
FAX: 852-27552064

**Winbond Electronics North America Corp.**

**Winbond Memory Lab.**  
**Winbond Microelectronics Corp.**  
**Winbond Systems Lab.**  
2727 N. First Street, San Jose,  
CA 95134, U.S.A.  
TEL: 408-9436666  
FAX: 408-5441798

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