Winbond Electronics Corp.

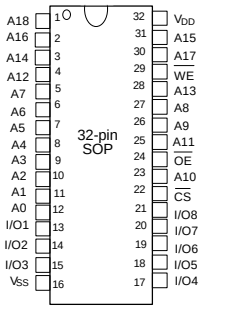
512K × 8 CMOS STATIC RAM

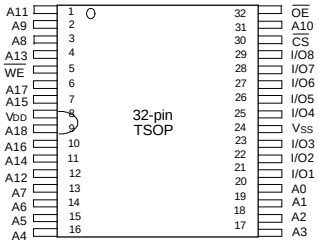
GENERAL DESCRIPTION

The W24L04 is a normal-speed, very low-power CMOS static RAM organized as 524288 × 8 bits that operates on a wide voltage range from 2.7V to 3.3V power supply. The W24L04, W24L04-LE and W24L04-LI, can meet the requirement of various operating temperature. This device is manufactured using Winbond's high performance CMOS technology.

FEATURES

- Low power consumption
- Access time: 70 nS
- 2.7V to 3.3V supply voltage
- Fully static operation
- All inputs and outputs directly TTL compatible
- Three-state outputs
- Battery back-up operation capability
- Data retention voltage: 1.5V (min.)
- Packaged in 32-pin 450 mil SOP, standard type one TSOP (8 mm × one TSOP (8 mm 13.4 mm) and 36 pin CSP

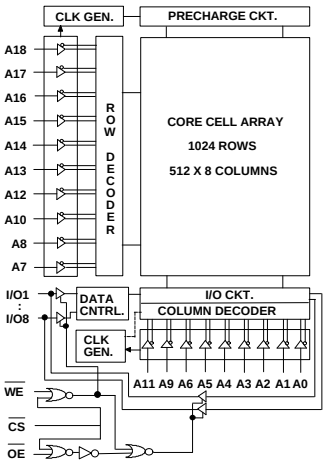




36-pin CSP TOP VIEW

	1	2	3	4	5	6
A	A0	A1	NC	A3	A6	A8
B	I/O5	A2	$\overline{WE}$	A4	A7	I/O1
C	I/O6		NC	A5		I/O2
D	V_{SS}					V_{CC}
E	V_{CC}					V_{SS}
F	I/O7		A18	A17		I/O3
G	I/O8	$\overline{OE}$	$\overline{CS}$	A16	A15	I/O4
H	A9	A10	A11	A12	A13	A14

BLOCK DIAGRAM



PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0–A18	Address Inputs
I/O1–I/O8	Data Inputs/Outputs
$\overline{CS}$	Chip Select Input
$\overline{WE}$	Write Enable Input
$\overline{OE}$	Output Enable Input
V_{DD}	Power Supply
V_{SS}	Ground
NC	No Connection

TRUTH TABLE

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	MODE	I/O1- I/O8	V_{DD} CURRENT
H	X	X	Not Selected	High Z	I_{SB}, I_{SB1}
L	H	H	Output Disable	High Z	I_{DD}
L	L	H	Read	Data Out	I_{DD}
L	X	L	Write	Data In	I_{DD}

DC CHARACTERISTICS

Absolute Maximum Ratings

PARAMETER		RATING	UNIT
Supply Voltage to V_{SS} Potential		-0.5 to +4.6	V
Input/Output to V_{SS} Potential		-0.5 to V_{DD} +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_{SS} = 0V; T_A (°C) = -20 to 85 for LE, -40 to 85 for LI)

PARAMETER	SYM.	TEST CONDITIONS	W24L04		UNIT
			MIN.	MAX.	
Operating Power Voltage	V_{DD}	-	2.7	3.3	V
Input Low Voltage	V_{IL}	-	-0.2	+0.4	V
Input High Voltage	V_{IH}	-	+2.2	V_{DD} +0.3	V
Input Leakage Current	I_{LI}	V_{IN} = V_{SS} to V_{DD}	-1	+1	µA
Output Leakage Current	I_{LO}	$V_{I/O}$ = V_{SS} to V_{DD} $\overline{CS}$ = V_{IH} (min.) or $\overline{OE}$ = V_{IH} (min.) or $\overline{WE}$ = V_{IL} (max.)	-1	+1	µA
Output Low Voltage	V_{OL}	I_{OL} = +2.1 mA	-	0.4	V
Output High Voltage	V_{OH}	I_{OH} = -1.0 mA	2.4	-	V

Operating Characteristics, continued

PARAMETER	SYM.	TEST CONDITIONS	W24L04		UNIT
			MIN.	MAX.	
Operating Power Supply Current	I_{DD}	$\overline{CS}$ = V_{IL} (max.) I/O = 0 mA Cycle = min. Duty = 100%	-	40	mA
Standby Power Supply Current	I_{SB}	$\overline{CS}$ = V_{IH} (min.) Duty = 100%	-	0.3	mA
	I_{SB1}	$\overline{CS}$ ≥ V_{DD} -0.2V	-	5	µA

CAPACITANCE

(T_A = 25° C, f = 1 MHz)

PARAMETER	SYM.	CONDITIONS	MAX.	UNIT
Input Capacitance	C_{IN}	V_{IN} = 0V	8	pF
Input/Output Capacitance	$C_{I/O}$	V_{OUT} = 0V	10	pF

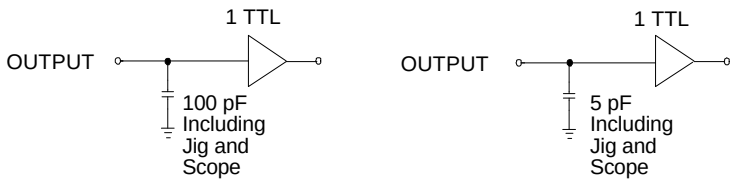
Note: These parameters are sampled but not 100% tested.

AC CHARACTERISTICS

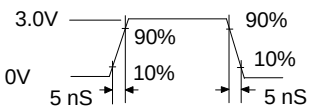
AC Test Conditions

PARAMETER	CONDITIONS
Input Pulse Levels	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



(For T_{CLZ}, T_{OLZ}, T_{CHZ}, T_{OHZ}, T_{WHZ}, T_{OW})



AC Characteristics, continued

(V_{SS} = 0V; T_A (°C) = -20 to 85 for LE, -40 to 85 for LI)

Read Cycle

PARAMETER	SYM.	W24L04		UNIT
		MIN.	MAX.	
Read Cycle Time	T_{RC}	70	-	nS
Address Access Time	T_{AA}	-	70	nS
Chip Select Access Time	T_{ACS}	-	70	nS
Output Enable to Output Valid	T_{AOE}	-	35	nS
Chip Selection to Output in Low Z	T_{CLZ}*	5	-	nS
Output Enable to Output in Low Z	T_{OLZ}*	3	-	nS
Chip Deselection to Output in High Z	T_{CHZ}*	-	30	nS
Output Disable to Output in High Z	T_{OHZ}*	-	30	nS
Output Hold from Address Change	T_{OH}	10	-	nS

*These parameters are sampled but not 100% tested

Write Cycle

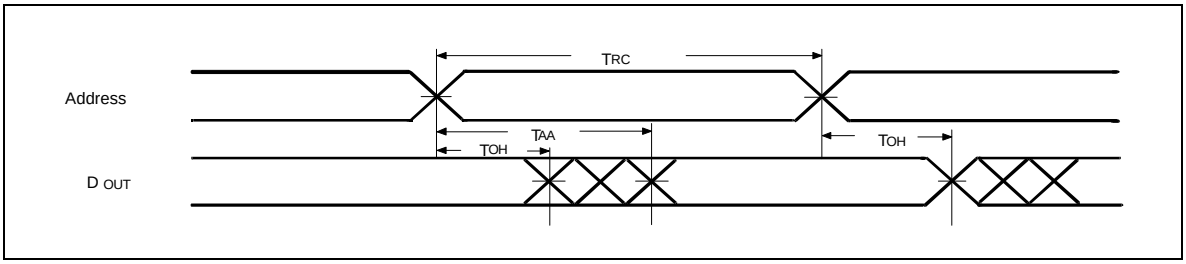
PARAMETER		SYM.	W24L04		UNIT
			MIN.	MAX.	
Write Cycle Time		T_{WC}	70	-	nS
Chip Selection to End of Write		T_{CW}	60	-	nS
Address Valid to End of Write		T_{AW}	60	-	nS
Address Setup Time		T_{AS}	0	-	nS
Write Pulse Width		T_{WP}	55	-	nS
Write Recovery Time	$\overline{CS}$, $\overline{WE}$	T_{WR}	0	-	nS
Data Valid to End of Write		T_{DW}	40	-	nS
Data Hold from End of Write		T_{DH}	0	-	nS
Write to Output in High Z		T_{WHZ}*	-	30	nS
Output Active from End of Write		T_{OW}	5	-	nS

*These parameters are sampled but not 100% tested

TIMING WAVEFORMS

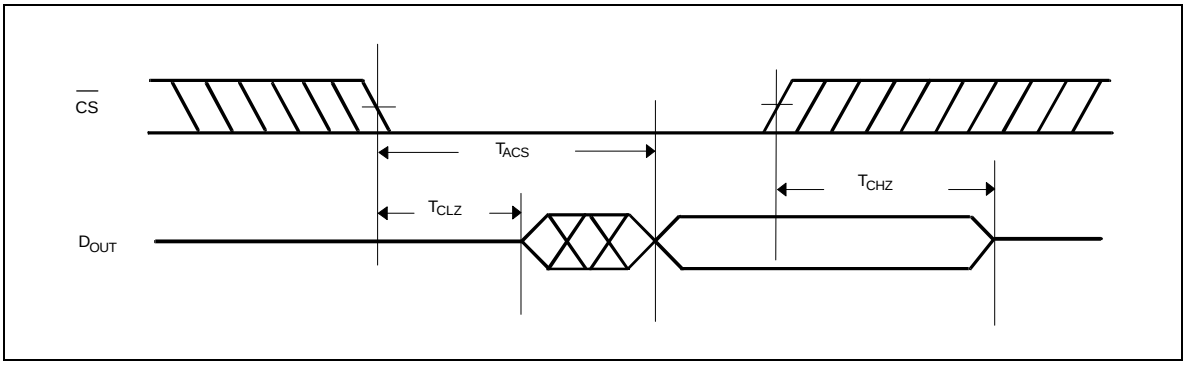
Read Cycle 1

(Address Controlled)



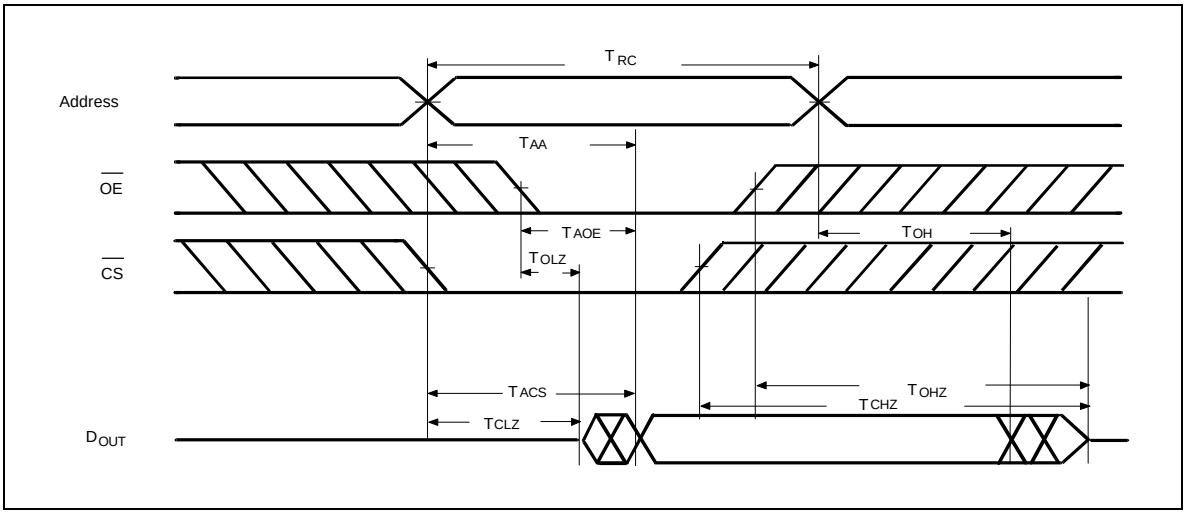
Read Cycle 2

(Chip Select Controlled)



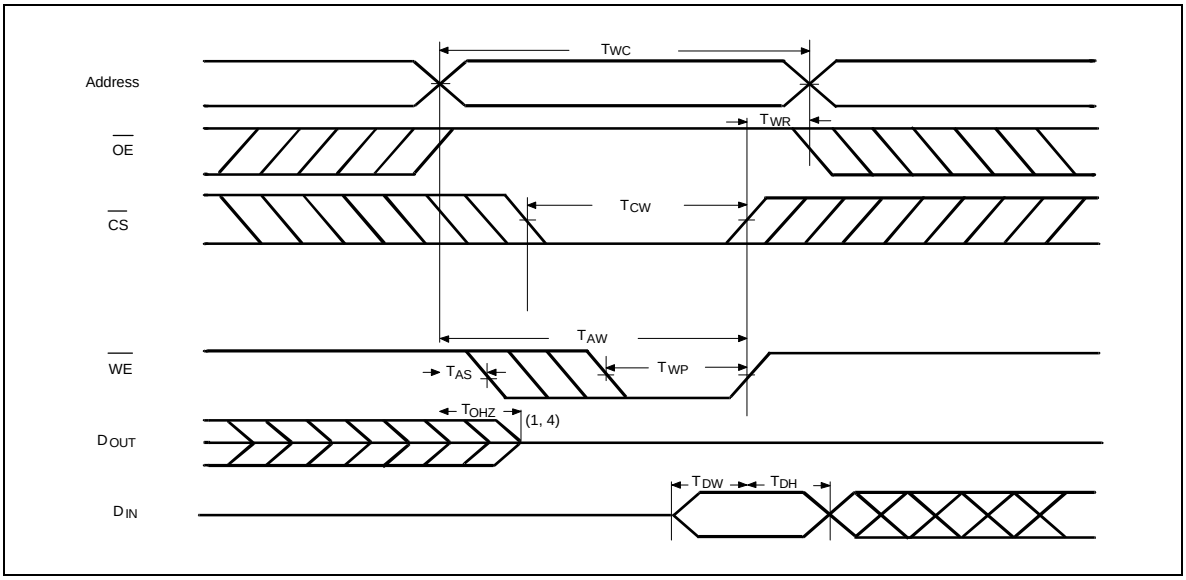
Read Cycle 3

(Output Enable Controlled)



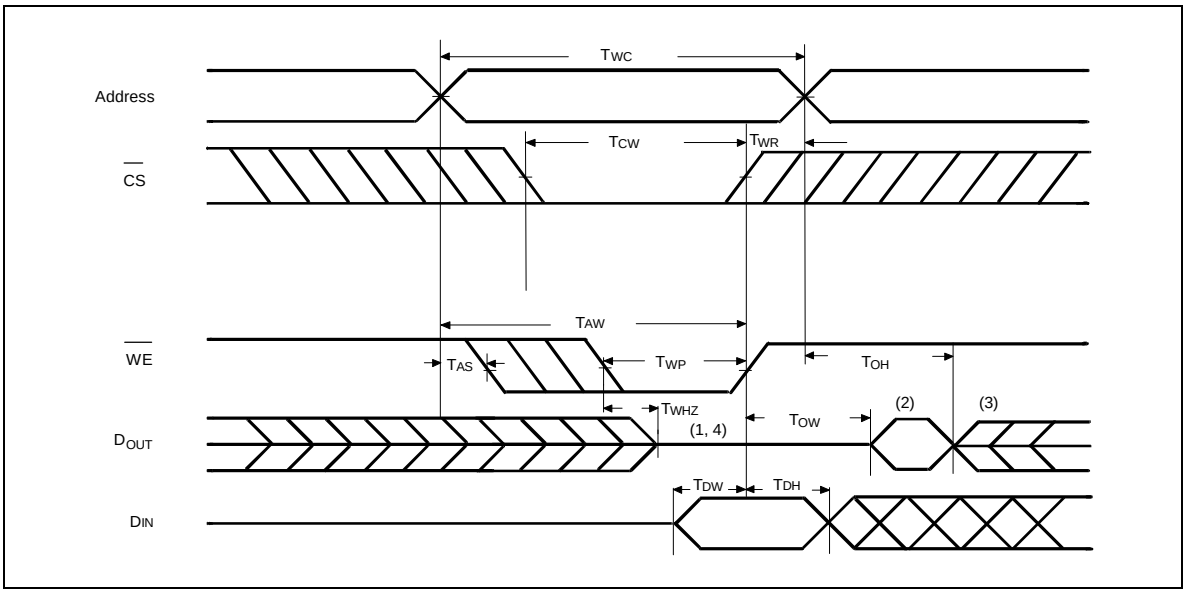
Timing Waveforms, continued

Write Cycle 1



Write Cycle 2

($\overline{OE}$ = 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 ±500 mV from steady state with CL = 5 pF. This parameter is guaranteed but not 100% tested.

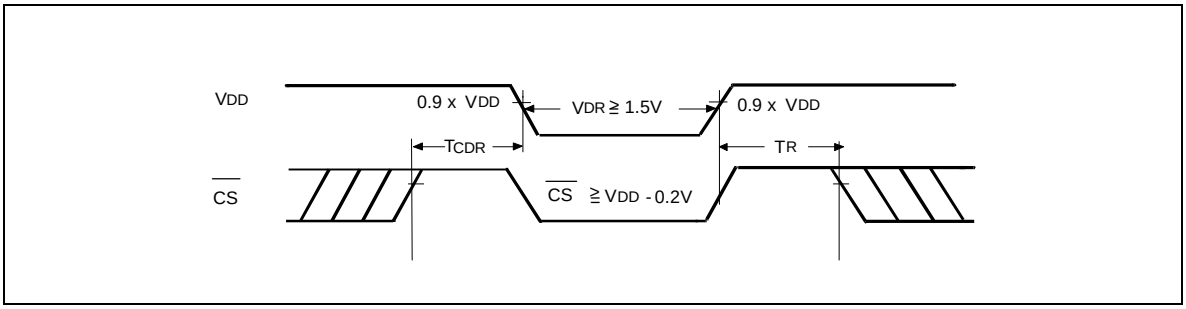
DATA RETENTION CHARACTERISTICS

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

PARAMETER	SYM.	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DD} for Data Retention	V_{DR}	$\overline{CS} \geq V_{DD}$ -0.2V	1.5	-	-	V
Data Retention Current	I_{DDDR}	$\overline{CS} \geq V_{DD}$ -0.2V, V_{DD} = 3.0V	-	-	5	µA
Chip Deselect to Data Retention Time	T_{CDR}	See data retention waveform	0	-	-	nS
Operation Recovery Time	T_R		T_{RC}*	-	-	nS

* Read Cycle Time

DATA RETENTION WAVEFORM



ORDERING INFORMATION

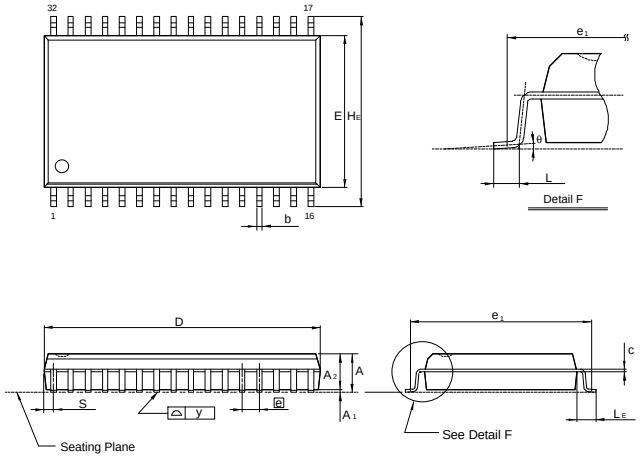
PART NO.	ACCESS TIME (nS)	OPERATING VOLTAGE (V) / STANDBY CURRENT (µA)	OPERATING TEMPERATURE (°C)	PACKAGE
W24L04B-70LE	70	3V / 5 µA	-20 to 85	CSP
W24L04Q-70LE	70	3V / 5 µA	-20 to 85	Small type one TSOP
W24L04S-70LE	70	3V / 5 µA	-20 to 85	450 mil SOP
W24L04T-70LE	70	3V / 5 µA	-20 to 85	Standard type one TSOP
W24L04B-70LI	70	3V / 5 µA	-40 to 85	CSP
W24L04Q-70LI	70	3V / 5 µA	-40 to 85	Small type one TSOP
W24L04S-70LI	70	3V / 5 µA	-40 to 85	450 mil SOP
W24L04T-70LI	70	3V / 5 µA	-40 to 85	Standard type one TSOP
W24L04B-70LL	70	3V / 20 µA	0 to 70	CSP
W24L04Q-70LL	70	3V / 20 µA	0 to 70	Small type one TSOP
W24L04S-70LL	70	3V / 20 µA	0 to 70	450 mil SOP
W24L04T-70LL	70	3V / 20 µA	0 to 70	Standard 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

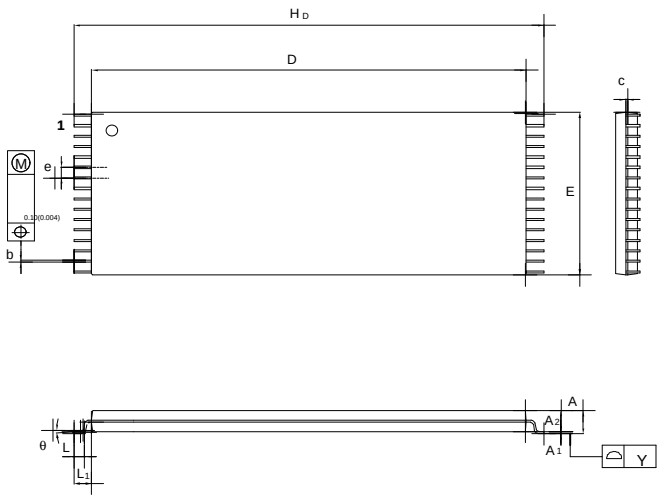
32-pin SOP Wide Body



Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.118	—	—	3.00
A_1	0.004	—	—	0.10	—	—
A_2	0.101	0.106	0.111	2.57	2.69	2.82
b	0.014	0.016	0.020	0.36	0.41	0.51
c	0.006	0.008	0.012	0.15	0.20	0.31
D	—	0.805	0.817	—	20.45	20.75
E	0.440	0.445	0.450	11.18	11.30	11.43
e	0.044	0.050	0.056	1.12	1.27	1.42
H_E	0.546	0.556	0.556	13.87	14.12	14.38
L	0.023	0.031	0.039	0.58	0.79	0.99
L_E	0.047	0.055	0.063	1.19	1.40	1.60
S	—	—	0.036	—	—	0.91
y	—	—	0.004	—	—	0.10
θ	0°	—	10°	0°	—	10°

Notes:
1. Dimensions D Max. & S include mold flash or tie bar burrs.
2. Dimension b does not include dambar protrusion/intrusion.
3. Dimensions D & E include mold mismatch and determined at the mold parting line.
4. Controlling dimension: Inches
5. General appearance spec should be based on final visual inspection spec.

32-pin Standard Type One TSOP

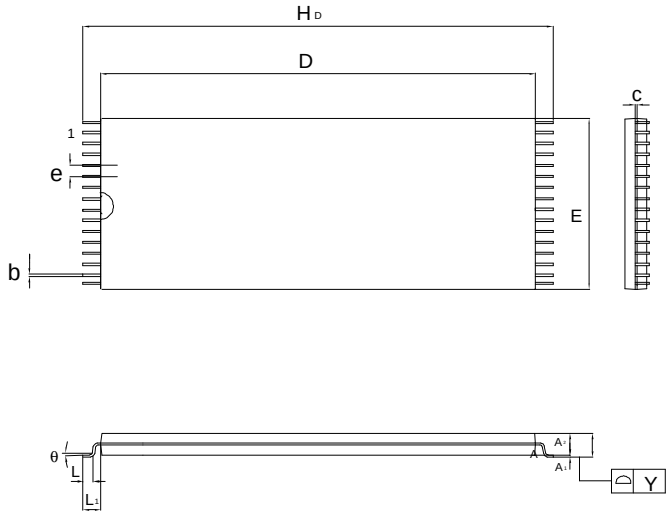


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.047	—	—	1.20
A_1	0.002	—	0.006	0.05	—	0.15
A_2	0.037	0.039	0.041	0.95	1.00	1.05
b	0.007	0.008	0.009	0.17	0.20	0.23
c	0.005	0.006	0.007	0.12	0.15	0.17
D	0.720	0.724	0.728	18.30	18.40	18.50
E	0.311	0.315	0.319	7.90	8.00	8.10
H_D	0.780	0.787	0.795	19.80	20.00	20.20
e	—	0.020	—	—	0.50	—
L	0.016	0.020	0.024	0.40	0.50	0.60
L_1	—	0.031	—	—	0.80	—
Y	0.000	—	0.004	0.00	—	0.10
θ	1	3	5	1	3	5

Controlling dimension: Millimeters

Package Dimensions, continued

32-pin Small Type One TSOP



Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.049	—	—	1.25
A_1	0.002	—	0.006	0.05	—	0.15
A_2	0.037	0.039	0.041	0.95	1.00	1.05
b	0.007	0.008	0.009	0.17	0.20	0.27
c	0.0056	0.0059	0.0062	0.14	0.15	0.16
D	0.461	0.465	0.469	11.70	11.80	11.90
E	0.311	0.315	0.319	7.90	8.00	8.10
H_D	0.520	0.528	0.536	13.20	13.40	13.60
e	—	0.020	—	—	0.50	—
L	0.012	0.020	0.028	0.30	0.50	0.70
L_1	0.027	—	—	0.675	—	—
Y	0.000	—	0.004	0.00	—	0.10
θ	0	3	5	0	3	5

Controlling dimension: Millimeters

VERSION HISTORY

VERSION	DATE	PAGE	DESCRIPTION
A1	Oct. 1999	-	Initial Issued
A2	Jan. 2000	1, 2, 3, 4, 8	W24L04 becomes W24L04 (2.7V–3.3V, 70 nS) A2 revision & W24V04 (2.3V–2.7V, 85 nS) A1 preliminary revision. Change the Operation Voltage & Access Time.

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