



## 8K × 8 CMOS STATIC RAM

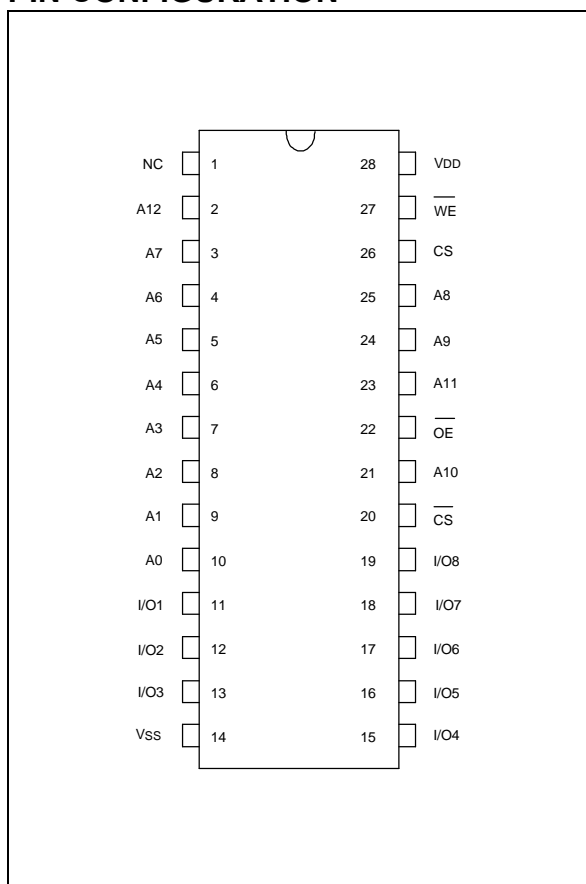
### GENERAL DESCRIPTION

The W2465 is a slow-speed, low-power CMOS static RAM organized as  $8192 \times 8$  bits that operates on a single 5-volt power supply. This device is manufactured using Winbond's high performance CMOS technology.

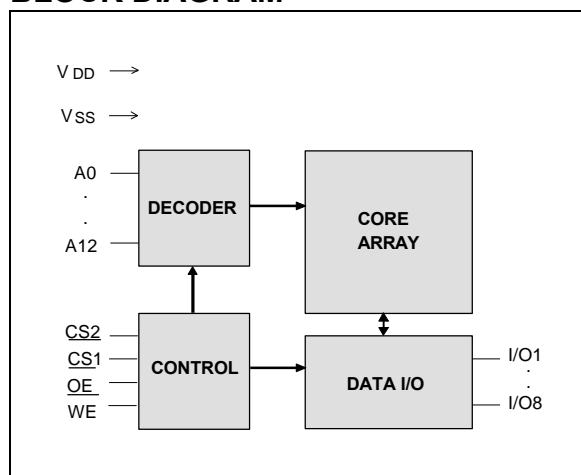
### FEATURES

- Low power consumption:
  - Active: 250 mW (max.)
  - Standby: 100  $\mu$ W (max.)(LL-version)  
250  $\mu$ W (max.)(L-version)
- Access time: 70/100 nS (max.)
- Single +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.)
- Available packages: 28-pin 600 mil DIP, 330 mil SOP and 300 mil skinny DIP

### PIN CONFIGURATION



### BLOCK DIAGRAM



### PIN DESCRIPTION

SYMBOL	DESCRIPTION
A0–A12	Address Inputs
I/O1–I/O8	Data Inputs/Outputs
CS1, CS2	Chip Select Inputs
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	0 to +70	°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>DD</sub> = 5V ±10%, V<sub>SS</sub> = 0V, T<sub>A</sub> = 0 to 70° C)

PARAMETER	SYM.	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Input Low Voltage	V <sub>IL</sub>	-		-0.5	-	+0.8	V
Input High Voltage	V <sub>IH</sub>	-		+2.2	-	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>		-2	-	+2	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.)		-2	-	+2	μA
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = +4.0 mA		-	-	0.4	V
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1.0 mA		2.4	-	-	V
Operating Power Supply Current	I <sub>DD</sub>	CS1 = V <sub>IL</sub> (max.), CS2 = V <sub>IH</sub> (min.) I/O = 0 mA, Cycle = min. Duty = 100%	70	-	-	70	mA
			100	-	-	60	mA
Standby Power Supply Current	I <sub>SB</sub>	CS1 = V <sub>IH</sub> (min.) or CS2 = V <sub>IL</sub> (max.), Cycle = min. Duty = 100%		-	-	3	mA
	I <sub>SB1</sub>	CS1 ≥ V <sub>DD</sub> -0.2V or CS2 ≤ 0.2V	LL	-	-	20	μA
			L	-	-	50	μA

Note: Typical characteristics are at V<sub>DD</sub> = 5 V, T<sub>A</sub> = 25° C.



## CAPACITANCE

(V<sub>DD</sub> = 5V, 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

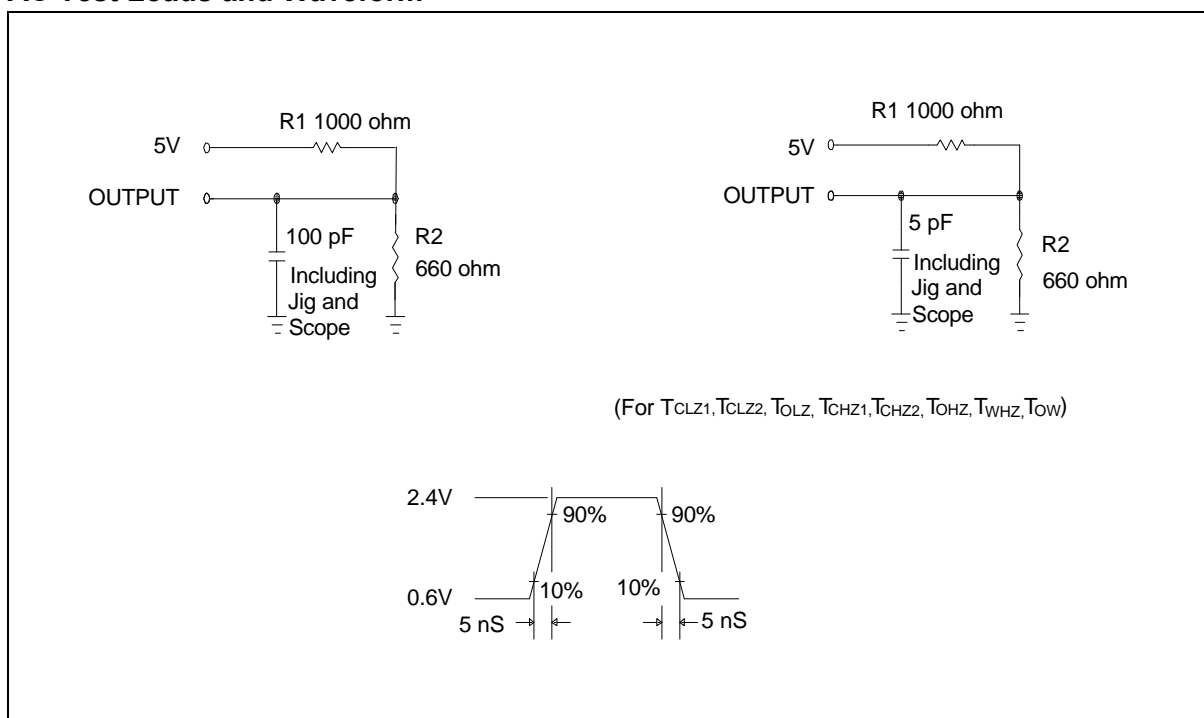
Note: These parameters are sampled but not 100% tested.

## AC CHARACTERISTICS

### AC Test Conditions

PARAMETER	CONDITIONS
Input Pulse Levels	0.6V to 2.4V
Input Rise and Fall Times	5 nS
Input and Output Timing Reference Level	1.5V
Output Load	C <sub>L</sub> = 100 pF, I <sub>OH</sub> /I <sub>OL</sub> = -1 mA/4 mA

### AC Test Loads and Waveform





AC Characteristics, continued

(V<sub>DD</sub> = 5V ±10%, V<sub>SS</sub> = 0V, T<sub>A</sub> = 0 to 70° C)

## Read Cycle

PARAMETER		SYM.	W2465-70		W2465-10		UNIT
			MIN.	MAX.	MIN.	MAX.	
Read Cycle Time		TRC	70	-	100	-	nS
Address Access Time		TAA	-	70	-	100	nS
Chip Select Access Time	$\overline{\text{CS1}}$	TACS1	-	70	-	100	nS
	CS2	TACS2	-	70	-	100	nS
Output Enable to Output Valid		TAOE	-	35	-	50	nS
Chip Selection to Output in Low Z	$\overline{\text{CS1}}$	TCLZ1*	5	-	10	-	nS
	CS2	TCLZ2*	5	-	10	-	nS
Output Enable to Output in Low Z		TOLZ*	5	-	5	-	nS
Chip Deselection to Output in High Z	$\overline{\text{CS1}}$	TCHZ1*	-	30	-	35	nS
	CS2	TCHZ2*	-	30	-	35	nS
Output Disable to Output in High Z		TOHZ*	-	30	-	35	nS
Output Hold from Address Change		TOH	10	-	10	-	nS

\* These parameters are sampled but not 100% tested.

## Write Cycle

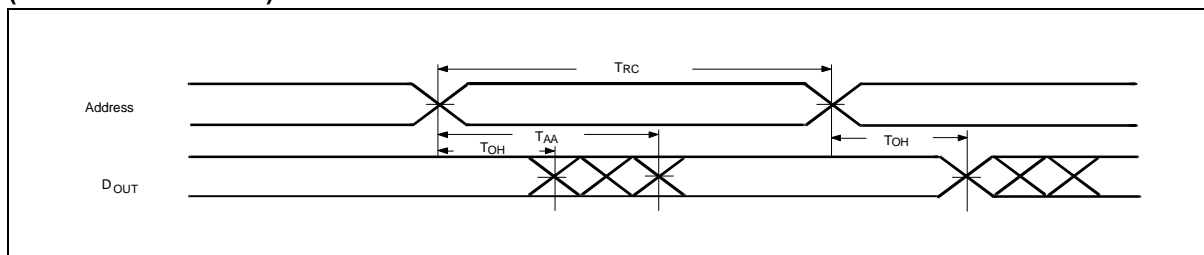
PARAMETER		SYM.	W2465-70		W2465-10		UNIT
			MIN.	MAX.	MIN.	MAX.	
Write Cycle Time		TWC	70	-	100	-	nS
Chip Selection to End of Write	$\overline{\text{CS1}}$	TCW1	60	-	80	-	nS
	CS2	TCW2	60	-	80	-	nS
Address Valid to End of Write		TAW	60	-	80	-	nS
Address Setup Time		TAS	0	-	0	-	nS
Write Pulse Width		TWP	45	-	60	-	nS
Write Recovery Time	$\overline{\text{CS1}}, \overline{\text{WE}}$	TWR1	0	-	0	-	nS
	CS2	TWR2	0	-	0	-	nS
Data Valid to End of Write		TDW	30	-	40	-	nS
Data Hold from End of Write		TDH	0	-	0	-	nS
Write to Output in High Z		TWHZ*	-	30	-	30	nS
Output Disable to Output in High Z		TOHZ*	-	30	-	30	nS
Output Active from End of Write		TOW	0	-	0	-	nS

\* These parameters are sampled but not 100% tested.

## TIMING WAVEFORMS

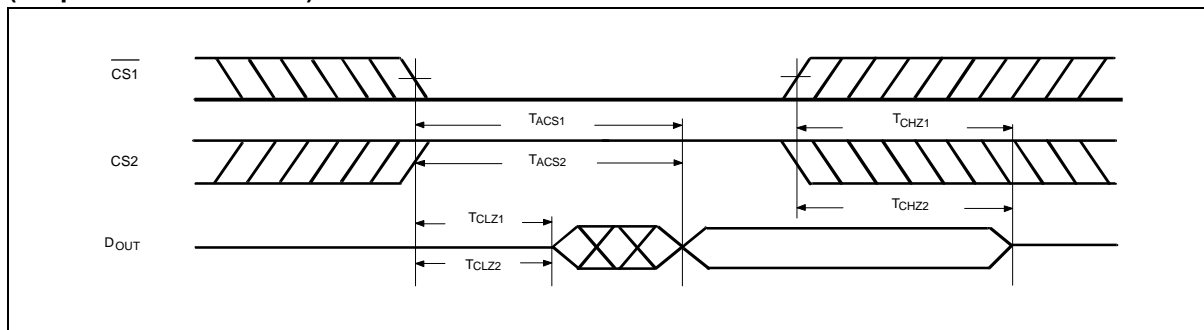
### Read Cycle 1

(Address Controlled)



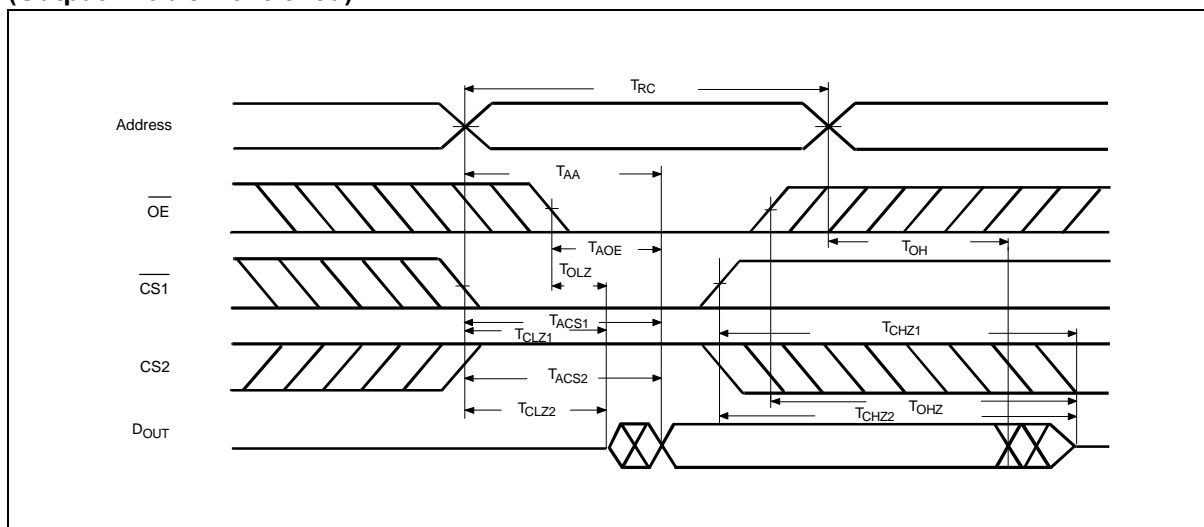
### Read Cycle 2

(Chip Select Controlled)



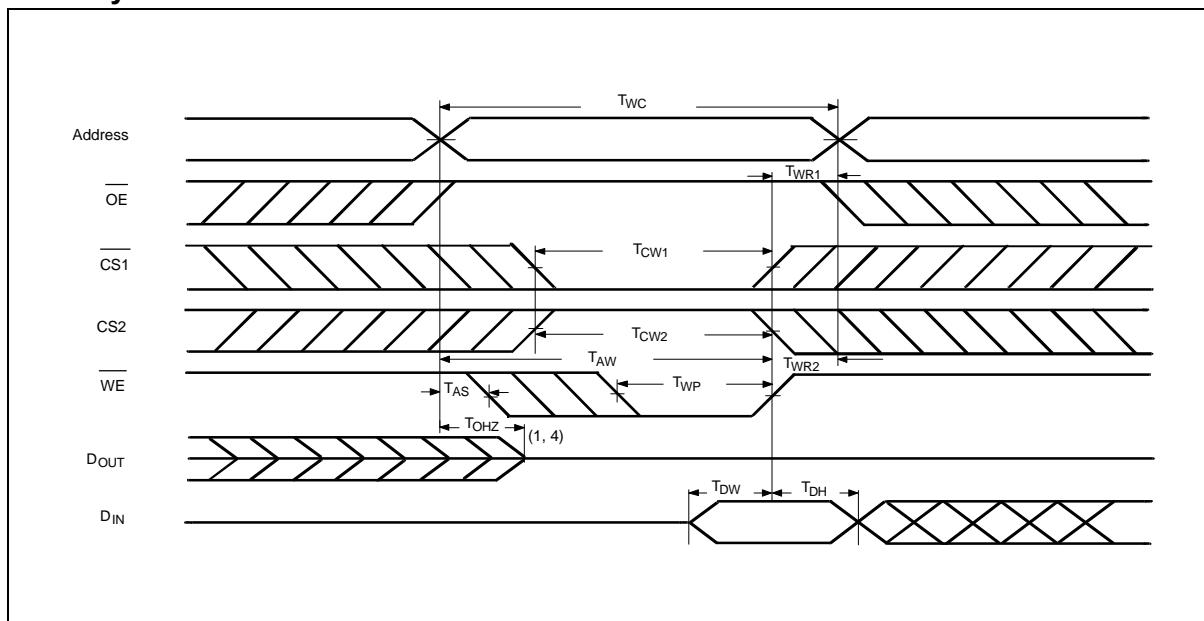
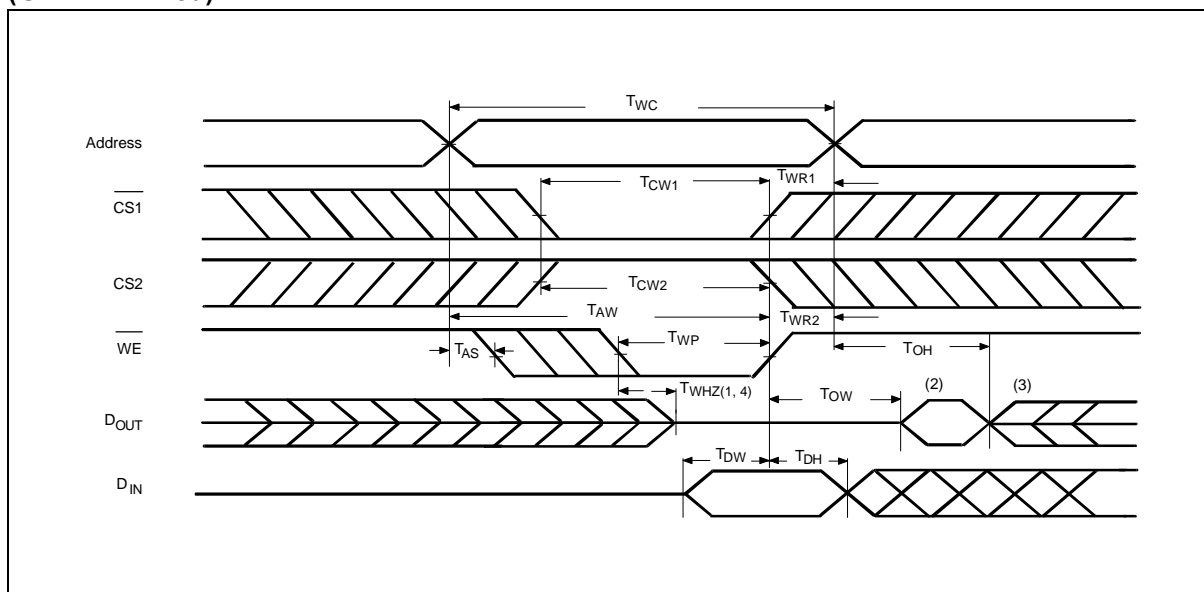
### Read Cycle 3

(Output Enable Controlled)





Timing Waveforms, continued

**Write Cycle 1****Write Cycle 2**(OE =  $V_{IL}$  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.

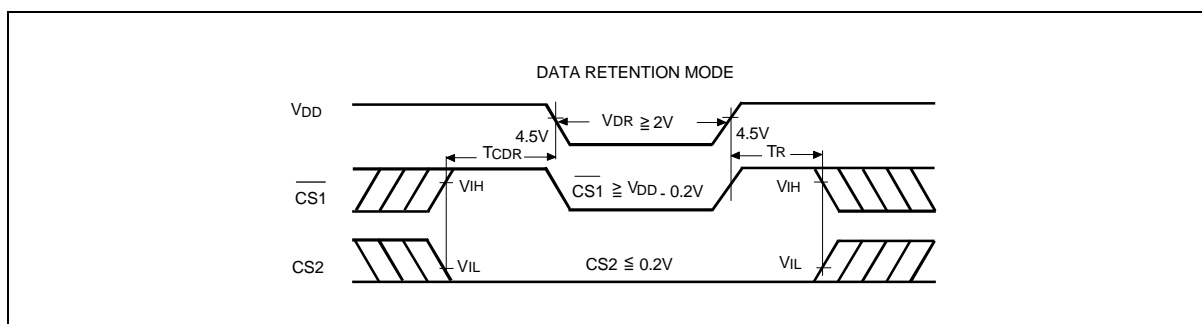
## DATA RETENTION CHARACTERISTICS

(TA = 0 to 70° C)

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	IDDDR	$\overline{CS1} \geq V_{DD} - 0.2V$ , or $CS2 \leq 0.2V$ $V_{DD} = 3V$	LL	-	-	10 $\mu A$
			L	-	-	20 $\mu A$
Chip Deselect to Data Retention Time	TCDR	See data retention waveforms	0	-	-	nS
Operation Recovery Time	TR		TRC*	-	-	nS

TRC\* = Read Cycle Time

## DATA RETENTION WAVEFORMS



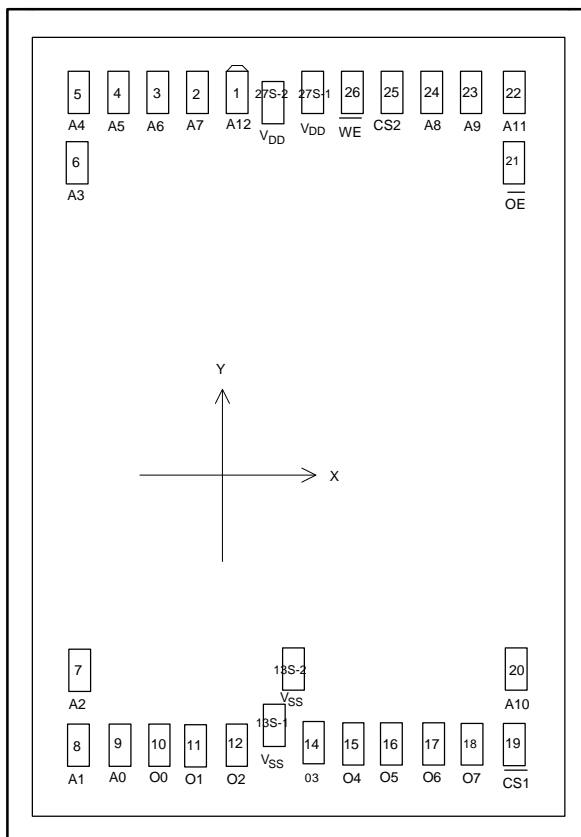
## ORDERING INFORMATION

PART NO.	ACCESS TIME (nS)	OPERATING CURRENT MAX. (mA)	STANDBY CURRENT MAX. ( $\mu A$ )	PACKAGE
W2465-70LL	70	70	20	600 mil DIP
W2465-10L	100	60	50	600 mil DIP
W2465S-70LL	70	70	20	330 mil SOP
W2465S-10L	100	60	50	330 mil SOP
W2465K-70LL	70	70	20	300 mil Skinny
W2465K-10L	100	60	50	300 mil Skinny

### Notes:

- Winbond reserves the right to make changes to its products without prior notice.
- 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.

## BONDING PAD DIAGRAM



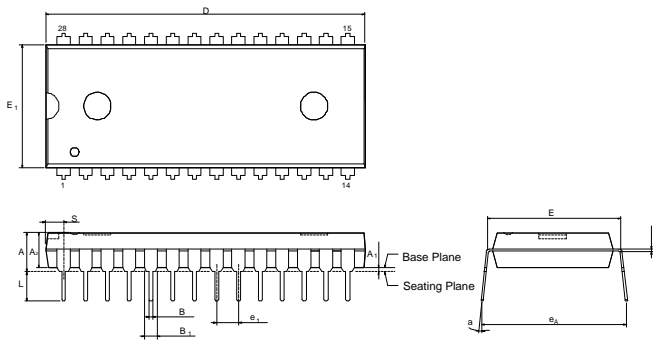
PAD NO.	X	Y
1	-226.95	1526.15
2	-350.95	1526.15
3	-484.10	1526.15
4	-608.10	1526.15
5	-739.75	1526.15
6	-741.75	1315.10
7	-741.75	-1231.85
8	-741.75	-1456.30
9	-610.60	-1456.30
10	-481.50	-1466.30
11	-343.80	-1466.30
12	-206.10	-1466.30
13S-1	-73.00	-1401.10
13S-2	-8.35	-1212.80
14	60.10	-1466.30
15	193.30	-1466.30
16	332.40	-1466.30
17	465.60	-1466.30
18	603.30	-1466.30
19	738.15	-1456.30
20	740.15	-1221.45
21	740.15	1310.80
22	738.15	1526.15
23	606.50	1526.15
24	482.50	1526.15
25	349.35	1526.15
26	225.35	1526.15
27S-1	94.20	1526.15
27S-2	-50.40	1456.10

Note: For bare chip form (C.O.B.) applications, the substrate must be connected to V<sub>DD</sub> or left floating in the PCB layout.



## PACKAGE DIMENSIONS

### 28-pin P-DIP

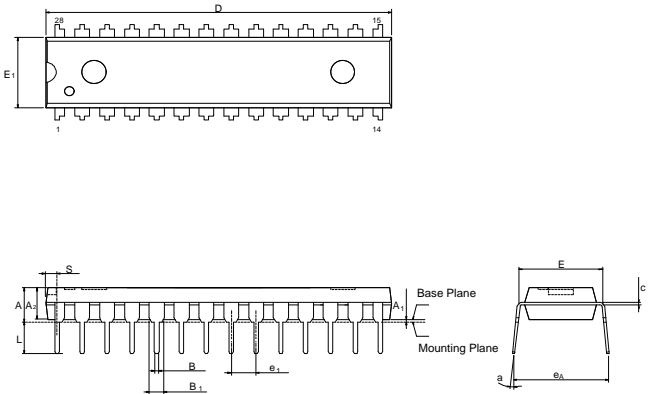


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.210	—	—	5.33
A <sub>1</sub>	0.010	—	—	0.25	—	—
A <sub>2</sub>	0.150	0.155	0.160	3.81	3.94	4.06
B	0.016	0.018	0.022	0.41	0.46	0.56
B <sub>1</sub>	0.058	0.060	0.064	1.47	1.52	1.63
c	0.008	0.010	0.014	0.20	0.25	0.36
D	—	1.460	1.470	—	37.08	37.34
E	0.590	0.600	0.610	14.99	15.24	15.49
E <sub>1</sub>	0.540	0.545	0.550	13.72	13.84	13.97
e <sub>1</sub>	0.090	0.100	0.110	2.29	2.54	2.79
L	0.120	0.130	0.140	3.05	3.30	3.56
a	0	—	15	0	—	15
e <sub>A</sub>	0.630	0.650	0.670	16.00	16.51	17.02
S	—	—	0.090	—	—	2.29

#### Notes:

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

### 28-pin P-DIP Skinny



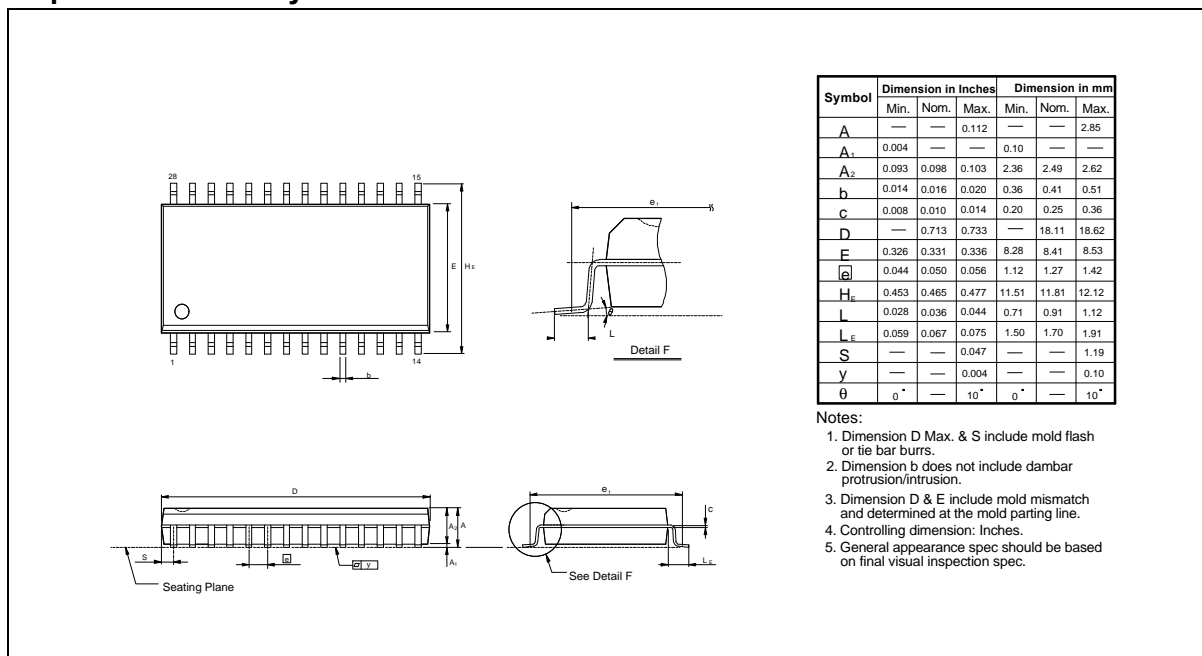
Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	0.175	—	—	4.45
A <sub>1</sub>	0.010	—	—	0.25	—	—
A <sub>2</sub>	0.125	0.130	0.135	3.18	3.30	3.43
B	0.016	0.018	0.022	0.41	0.46	0.56
B <sub>1</sub>	0.058	0.060	0.064	1.47	1.52	1.63
c	0.008	0.010	0.014	0.20	0.25	0.36
D	—	1.388	1.400	—	35.26	35.56
E	0.300	0.310	0.320	7.62	7.87	8.13
E <sub>1</sub>	0.283	0.288	0.293	7.19	7.32	7.44
e <sub>1</sub>	0.090	0.100	0.110	2.29	2.54	2.79
L	0.120	0.130	0.140	3.05	3.30	3.56
a	0°	—	15°	0°	—	15°
e <sub>A</sub>	0.330	0.350	0.370	8.38	8.89	9.40
S	—	—	0.055	—	—	1.40

#### Notes:

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



Package Dimensions, continued

**28-pin SO Wide Body****Headquarters**

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