



M68Z512W

4 Mbit (512 Kbit x 8) LOW VOLTAGE, LOW POWER SRAM WITH OUTPUT ENABLE

FEATURES SUMMARY

- ULTRA LOW DATA RETENTION CURRENT
 - 400nA (typical)
 - 10 μ A (max)
- OPERATION VOLTAGE: 2.7 TO 3.6V
- 512 Kbit x 8 SRAM WITH OUTPUT ENABLE
- EQUAL CYCLE and ACCESS TIMES: 70ns
- LOW V_{CC} DATA RETENTION: 1V
- TRI-STATE COMMON I/O
- CMOS FOR OPTIMUM SPEED/POWER
- AUTOMATIC POWER-DOWN WHEN DESELECTED
- INTENDED FOR USE WITH ST ZEROPOWER[®] AND TIMEKEEPER[®] SUPERVISORS

Figure 1. 32-pin TSOP Package

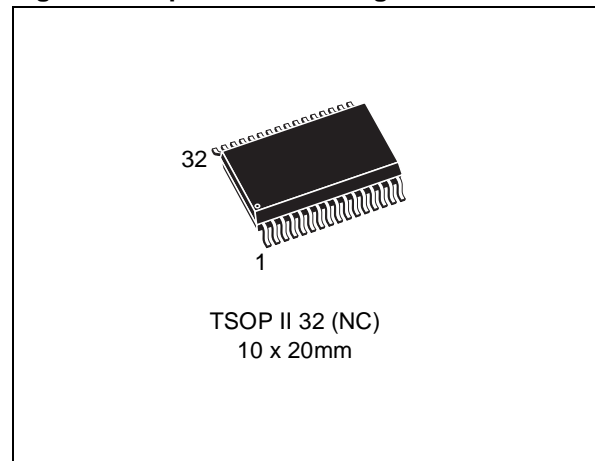


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DESCRIPTION

The M68Z512W is a 4Mbit (4,194,304 bit) CMOS SRAM, organized as 524,288 words by 8 bits. The device features fully static operation requiring no external clocks or timing strobes, with equal address access and cycle times. It requires a single 3V ±10% supply, and all inputs and outputs are TTL compatible.

This device has an automatic power-down feature, reducing the power consumption by over 99% when deselected.

The M68Z512W is available in a 32-lead TSOP II (10 x 20mm) package.

Figure 2. Logic Diagram

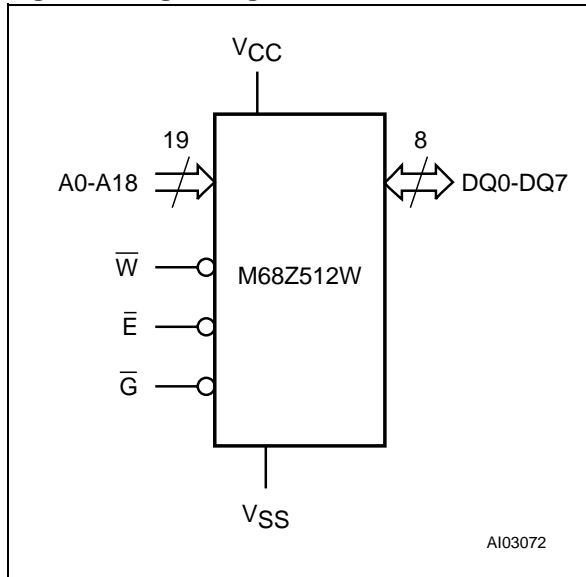


Table 1. Signal Names

A0-A18	Address Inputs
DQ0-DQ7	Data Input/Output
E-bar	Chip Enable
G-bar	Output Enable
W-bar	Write Enable
VCC	Supply Voltage
VSS	Ground

Figure 3. TSOP Connections

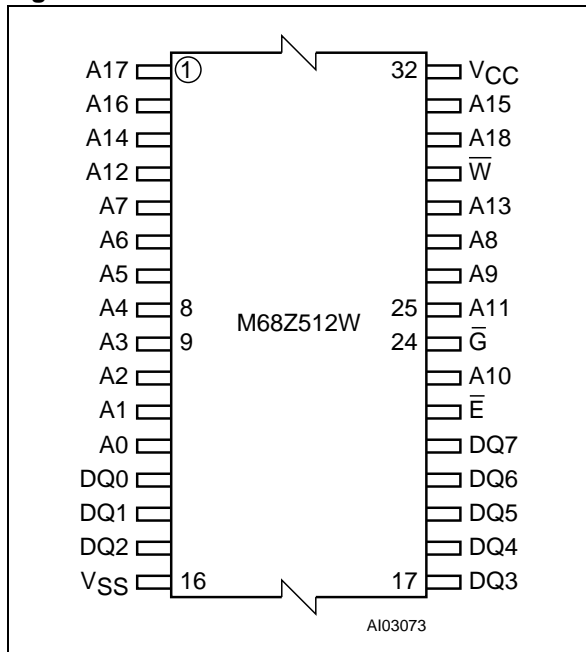
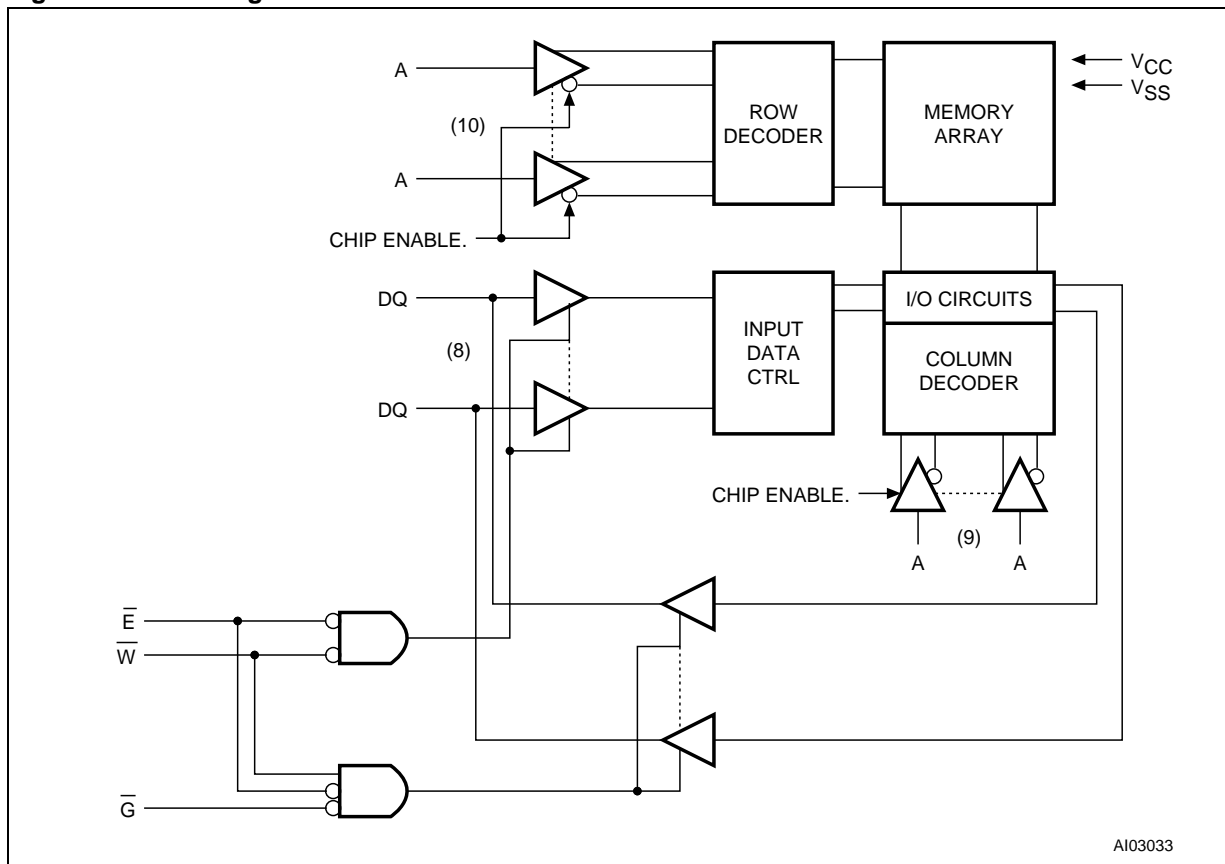


Figure 4. Block Diagram



MAXIMUM RATING

Stressing the device above the rating listed in the “Absolute Maximum Ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is

not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 2. Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
T _A	Ambient Operating Temperature	0 to 70	°C
T _{STG} ⁽¹⁾	Storage Temperature	-65 to 150	°C
V _{IO} ⁽²⁾	Input or Output Voltage	-0.3 to V _{CC} + 0.3	V
V _{CC}	Supply Voltage	-0.3 to 4.6	V
I _O ⁽³⁾	Output Current	20	mA
P _D	Power Dissipation	1	W

Note: 1. Reflow at peak temperature of 215°C to 225°C for < 60 seconds (total thermal budget not to exceed 180°C for between 90 and 120 seconds).
 2. Up to a maximum operating V_{CC} of 3.6V only.
 3. One output at a time, not to exceed 1 second duration.

DC AND AC PARAMETERS

This section summarizes the operating and measurement conditions, as well as the DC and AC characteristics of the device. The parameters in the following DC and AC Characteristic tables are derived from tests performed under the Measure-

ment Conditions listed in the relevant tables. Designers should check that the operating conditions in their projects match the measurement conditions when using the quoted parameters.

Table 3. DC and AC Measurement Conditions

Parameter	M68Z512W
V _{CC} Supply Voltage	2.7 to 3.6V
Ambient Operating Temperature	0 to 70°C
Load Capacitance (C _L)	30pF
Input Rise and Fall Times	≤ 5ns
Input Pulse Voltages	0 to 3V
Input and Output Timing Ref. Voltages	1.5V

Figure 5. AC Testing Load Circuit

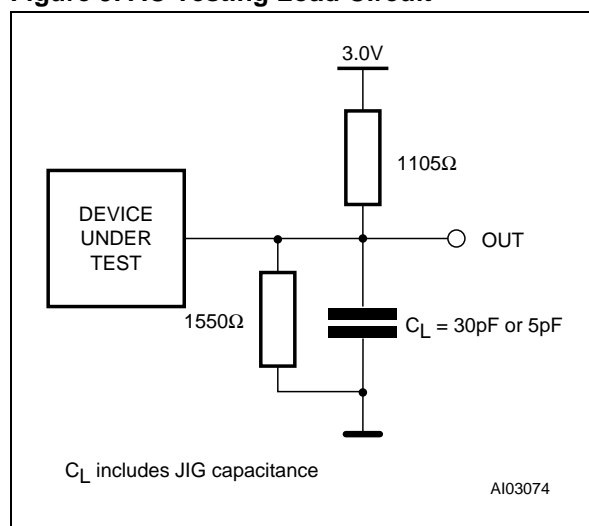


Table 4. Capacitance

Symbol	Parameter ^(1,2)	Min	Max	Unit
C _{IN}	Input Capacitance on all pins (except DQ)		6	pF
C _{OUT} ⁽³⁾	Output Capacitance		8	pF

Note: 1. Effective capacitance measured with power supply at 3V; sampled only, not 100% tested.
 2. At 25°C, f = 1MHz.
 3. Outputs deselected.

Table 5. DC Characteristics

Symbol	Parameter	Test Condition ⁽¹⁾	Min	Typ	Max	Unit
I _{LI}	Input Leakage Current	0V ≤ V _{IN} ≤ V _{CC}			±1	μA
I _{LO}	Output Leakage Current	0V ≤ V _{OUT} ≤ V _{CC}			±1	μA
I _{CC1} ⁽²⁾	Supply Current	V _{CC} = 3.6V		7	15	mA
I _{CC2} ⁽³⁾	Supply Current (Standby) TTL	V _{CC} = 3.6V, $\bar{E} = V_{IH}$			100	μA
I _{CC3} ⁽⁴⁾	Supply Current (Standby) CMOS	V _{CC} = 3.6V, $\bar{E} \geq V_{CC} - 0.3V, f = 0$		2	20	μA
V _{IL}	Input Low Voltage		-0.3		0.8	V
V _{IH}	Input High Voltage		2.2		V _{CC} + 0.3	V
V _{OL}	Output Low Voltage	I _{OL} = 2.1mA			0.4	V
V _{OH}	Output High Voltage	I _{OH} = -1mA	2.4			V

Note: 1. Valid for Ambient Operating Temperature: T_A = 0 to 70°C; V_{CC} = 2.7 to 3.6V (except where noted).
 2. Average AC current, Outputs open, cycling at t_{AVAV} minimum.
 3. All other Inputs at V_{IL} ≤ 0.8V or V_{IH} ≥ 2.2V.
 4. All other Inputs at V_{IL} ≤ 0.3V or V_{IH} ≥ V_{CC} - 0.3V.

OPERATION

The M68Z512W has a Chip Enable power down feature which invokes an automatic standby mode whenever Chip Enable is de-asserted ($\bar{E} = \text{High}$). An Output Enable (\bar{G}) signal provides a high speed tri-state control, allowing fast READ/WRITE

Cycles to be achieved with the common I/O data bus. Operational modes are determined by device control inputs \bar{W} and \bar{E} as summarized in the Operating Modes table (see Table 6).

Table 6. Operating Modes

Operation	\bar{E}	\bar{W}	\bar{G}	DQ0-DQ7	Power
Read	V _{IL}	V _{IH}	V _{IH}	Hi-Z	Active
Read	V _{IL}	V _{IH}	V _{IL}	Data Output	Active
Write	V _{IL}	V _{IL}	X	Data Input	Active
Deselect	V _{IH}	X	X	Hi-Z	Standby

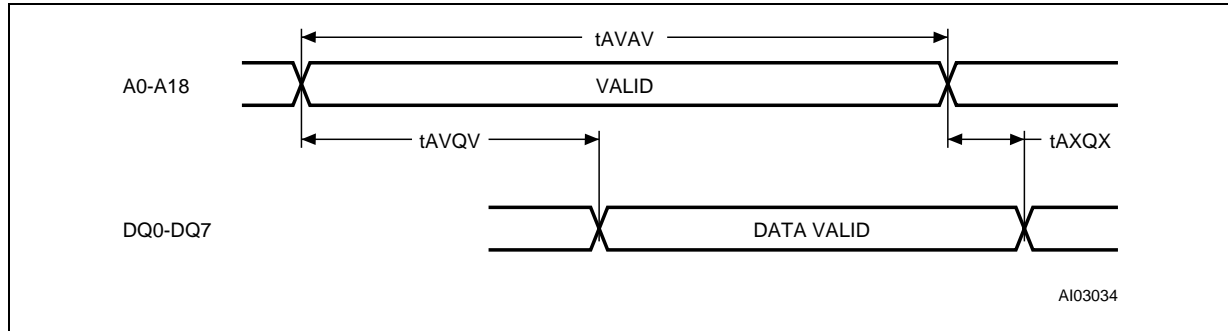
Note: X = V_{IH} or V_{IL}.

READ Mode

The M68Z512W is in the READ Mode whenever WRITE Enable (\overline{W}) is High with Output Enable (\overline{G}) Low, and Chip Enable (\overline{E}) is asserted. This provides access to data from eight of the 4,194,304 locations in the static memory array, specified by the 19 address inputs. Valid data will be available at the eight output pins within t_{AVQV} after the last

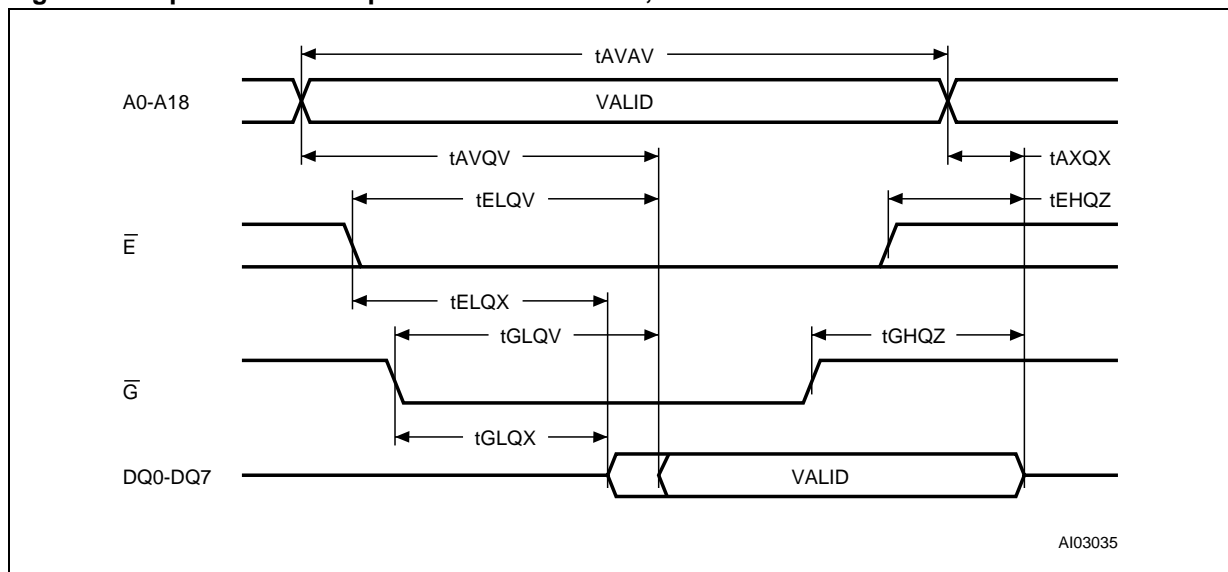
stable address, providing \overline{G} is Low and \overline{E} is Low. If Chip Enable or Output Enable access times are not met, data access will be measured from the limiting parameter (t_{ELQV} or t_{GLQV}) rather than the address. Data out may be indeterminate at t_{ELQX} and t_{GLQX} , but data lines will always be valid at t_{AVQV} .

Figure 6. Address Controlled, READ Mode AC Waveforms



Note: \overline{E} = Low, \overline{G} = Low, \overline{W} = High.

Figure 7. Chip Enable or Output Enable Controlled, READ Mode AC Waveforms



Note: Write Enable (\overline{W}) = High.

Figure 8. Standby Mode AC Waveforms

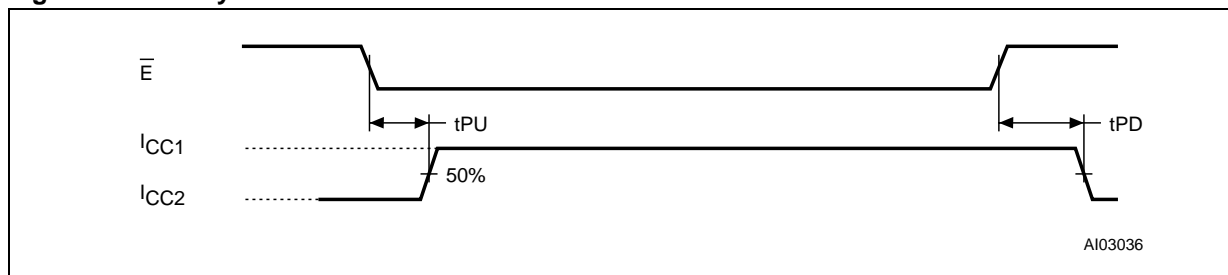


Table 7. READ Mode AC Characteristics

Symbol	Parameter ⁽¹⁾	M68Z512W		Unit
		Min	Max	
t _{AVAV}	READ Cycle Time	70		ns
t _{AVQV}	Address Valid to Output Valid		70	ns
t _{ELQV}	Chip Enable Low to Output Valid		70	ns
t _{GLQV}	Output Enable Low to Output Valid		35	ns
t _{ELQX} ⁽³⁾	Chip Enable Low to Output Transition	10		ns
t _{GLQX} ⁽³⁾	Output Enable Low to Output Transition	5		ns
t _{EHQZ} ^(2,3)	Chip Enable High to Output Hi-Z		25	ns
t _{GHQZ} ^(2,3)	Output Enable High to Output Hi-Z		25	ns
t _{AXQX}	Address Transition to Output Transition	10		ns
t _{PU}	Chip Enable Low to Power Up	0		ns
t _{PD}	Chip Enable High to Power Down		70	ns

Note: 1. Valid for Ambient Operating Temperature: T_A = 0 to 70°C; V_{CC} = 2.7 to 3.6V (except where noted).

2. C_L = 5pF.

3. At any given temperature and voltage condition, t_{EHQZ} is less than t_{ELQX} and t_{GHQZ} is less than t_{GLQX} for any given device.

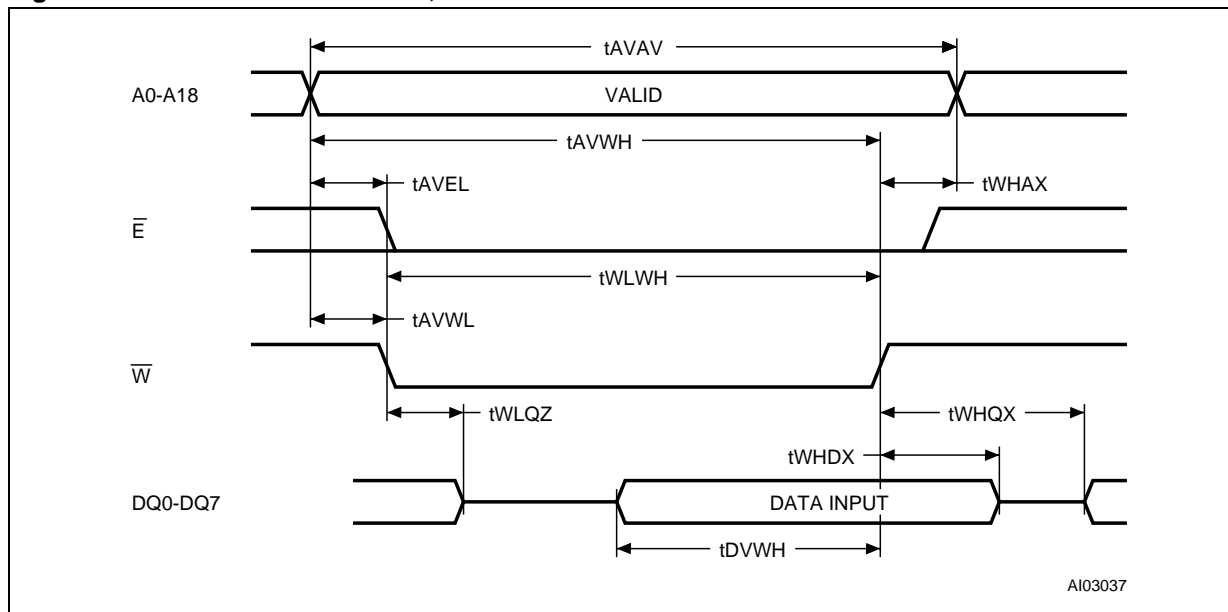
WRITE Mode

The M68Z512W is in the WRITE mode whenever the \overline{W} and \overline{E} pins are Low. Either the Chip Enable input (\overline{E}) or the WRITE Enable input (\overline{W}) must be de-asserted during Address transitions for subsequent WRITE cycles. Write begins with the concurrence of Chip Enable being active with \overline{W} low. Therefore, address setup time is referenced to WRITE Enable and Chip Enable as t_{AVWL} and t_{AVEH} respectively, and is determined by the latter occurring edge.

The WRITE Cycle can be terminated by the earlier rising edge of \overline{E} , or \overline{W} .

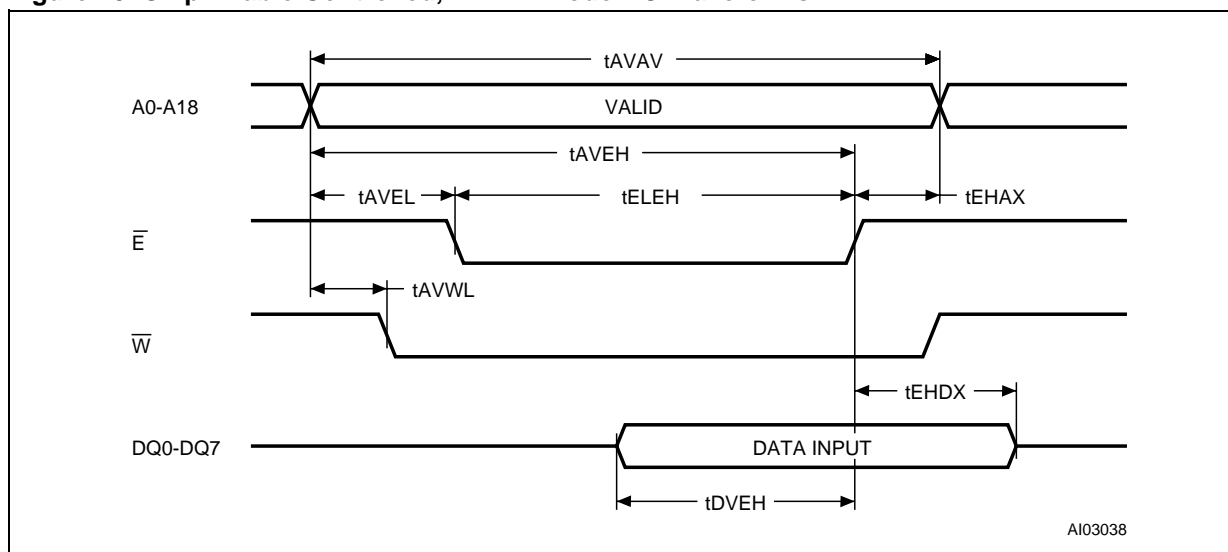
If the Output is enabled ($\overline{E} = \text{Low}$ and $\overline{G} = \text{Low}$), then \overline{W} will return the outputs to high impedance within t_{WLQZ} of its falling edge. Care must be taken to avoid bus contention in this type of operation. Data input must be valid for t_{DVWH} before the rising edge of WRITE Enable, or for t_{DVEH} before the rising edge of \overline{E} , whichever occurs first, and remain valid for t_{WHDX} or t_{EHDX} .

Figure 9. Write Enable Controlled, WRITE Mode AC Waveforms



Note: Output Enable (\overline{G}) = Low.

Figure 10. Chip Enable Controlled, WRITE Mode AC Waveforms



Note: If \overline{E} goes High with \overline{W} High, the output remains in a high-impedance state, and Output Enable (\overline{G}) = Low

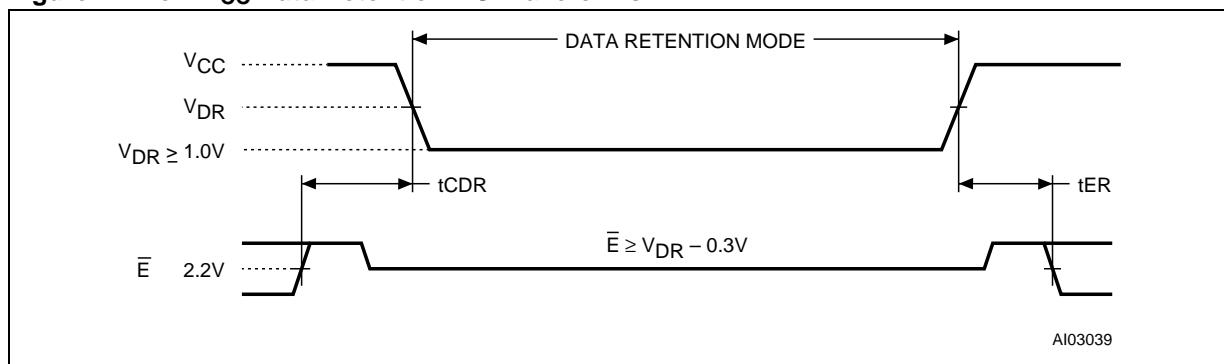
Table 8. WRITE Mode AC Characteristics

Symbol	Parameter ⁽¹⁾	M68Z512W		Unit
		Min	Max	
t _{AVAV}	WRITE Cycle Time	70		ns
t _{AVWL}	Address Valid to WRITE Enable Low	0		ns
t _{AVWH}	Address Valid to WRITE Enable High	60		ns
t _{AVEH}	Address Valid to Chip Enable High	60		ns
t _{WLWH}	WRITE Enable Pulse Width	50		ns
t _{WHAX}	WRITE Enable High to Address Transition	0		ns
t _{WHDX}	WRITE Enable High to Input Transition	0		ns
t _{WHQX} ⁽³⁾	WRITE Enable High to Output Transition	5		ns
t _{WLQZ} ^(2,3)	WRITE Enable Low to Output Hi-Z		25	ns
t _{AVEL}	Address Valid to Chip Enable Low	0		ns
t _{ELEH}	Chip Enable Low to Chip Enable High	60		ns
t _{EHAX}	Chip Enable High to Address Transition	0		ns
t _{DVWH}	Input Valid to Write Enable High	30		ns
t _{DVEH}	Input Valid to Chip Enable High	30		ns

Note: 1. Valid for Ambient Operating Temperature: T_A = 0 to 70°C; V_{CC} = 2.7 to 3.6V (except where noted).

2. C_L = 5pF

3. At any given temperature and voltage condition, t_{WLQZ} is less than t_{WHQX} for any given device.

Figure 11. Low V_{CC} Data Retention AC WaveformsTable 9. Low V_{CC} Data Retention Characteristics

Symbol	Parameter ⁽¹⁾	Test Condition	Min	Typ	Max	Unit
$I_{CCDR}^{(2)}$	Supply Current (Data Retention)	$V_{CC} = 3V, \bar{E} \geq V_{CC} - 0.3V$		0.4	10	μA
V_{DR}	Supply Voltage (Data Retention)	$\bar{E} \geq V_{CC} - 0.3V, f = 0$	1			V
t_{CDR}	Chip Disable to Power Down	$\bar{E} \geq V_{CC} - 0.3V, f = 0$	0			ns
$t_{ER}^{(3,4)}$	Operation Recovery Time		t_{AVAV}			ns

Note: 1. Valid for Ambient Operating Temperature: $T_A = 0$ to $70^\circ C$; $V_{CC} = 2.7$ to $3.6V$ (except where noted).

2. Typical condition: $T_A = 25^\circ C$.

3. See Figure 11 for measurement points. Guaranteed but not tested. t_{AVAV} is READ Cycle time.

4. Full device AC operation requires linear V_{CC} ramp from V_{DR} to V_{CC} (min) $\geq 10\mu s$ or stable at V_{CC} (min) $\geq 10\mu s$.

M68Z512W

PART NUMBERING

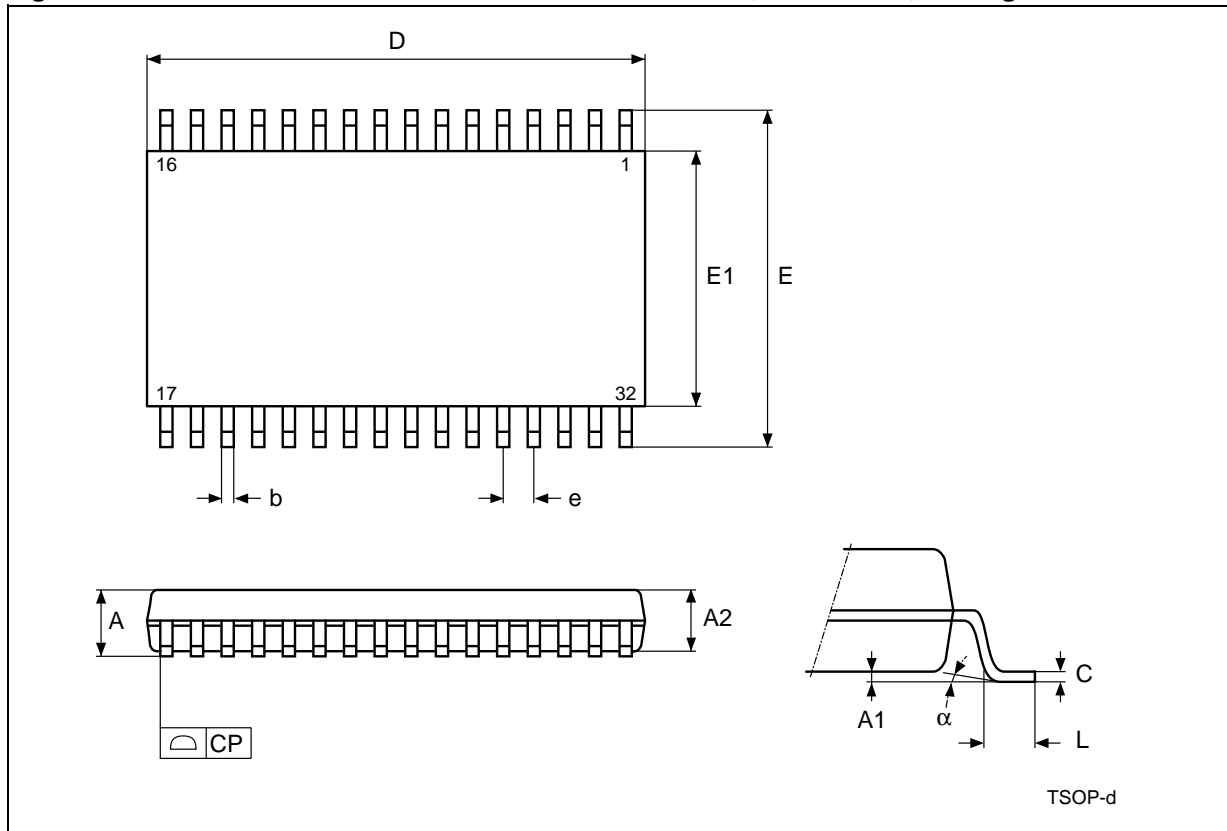
Table 10. Ordering Information Example

Example:	M68Z	512	W	-70	NC	1
Device Type						
M68Z						
Device Function						
512 = 4 Mbit (512Kb x8)						
Operating Voltage						
W = 2.7 to 3.6V						
Speed						
-70 = 70ns						
Package						
NC = TSOP II 32-Lead (10 x 20mm)						
Temperature Range						
1 = 0 to 70°C						

For a list of available options (e.g., Speed, Package) or for further information on any aspect of this device, please contact the ST Sales Office nearest to you.

PACKAGE MECHANICAL INFORMATION

Figure 12. TSOP II 32 – 32-lead Plastic Thin Small Outline II, 10 x 20 mm, Package Outline



Note: Drawing is not to scale.

Table 11. TSOP II 32 – 32-lead Plastic Thin Small Outline II, 10 x 20 mm, Package Mechanical Data

Symb	mm			inches		
	Min	Typ	Max	Min	Typ	Max
A			1.20			0.047
A1		0.05	0.15		0.002	0.006
A2		0.95	1.05		0.037	0.041
b		0.30	0.52		0.012	0.020
C		0.12	0.21		0.005	0.008
CP			0.10			0.004
D		20.82	21.08		0.820	0.830
e	1.27	–	–	0.050	–	–
E		11.56	11.96		0.455	0.471
E1		10.03	10.29		0.395	0.405
L		0.40	0.60		0.016	0.024
alpha		0°	5°		0°	5°
N		32			32	

REVISION HISTORY**Table 12. Document Revision History**

Date	Revision Details
July 1999	First Issue
06/28/00	TSOP32 II Package Dimension Changed (Table 11) From Target Specification To Preliminary Data
07/26/00	Ordering Information Scheme changed (Table 10)
09/21/00	ICCDR Supply Current changed (Table 9)
06/07/01	Reformatted; temp./voltage info. added to tables (Table 4, 5, 7, 8, 9); product status change
07/23/01	Routine maintenance (based on recent data sheet review findings)
05/13/02	Add reflow time and temperature footnote (Table 2)

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