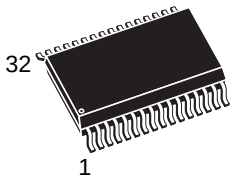
M68Z512

4 Mbit (512Kb x8) Low Power SRAM with Output Enable

- ULTRA LOW DATA RETENTION CURRENT
  - 100nA (typical)
  - 10µA (max)
- OPERATION VOLTAGE: 5V ±10%
- 512 Kbit x8 SRAM with OUTPUT ENABLE
- EQUAL CYCLE and ACCESS TIMES: 70ns
- LOW V_{CC} DATA RETENTION: 2V
- TRI-STATE COMMON I/O
- CMOS for OPTIMUM SPEED/POWER
- AUTOMATIC POWER-DOWN WHEN DESELECTED
- INTENDED FOR USE WITH ST ZEROPOWER® AND TIMEKEEPER® CONTROLLERS



TSOP II 32 (NC)
10 x 20mm

DESCRIPTION

The M68Z512 is a 4 Mbit (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 5V ±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 M68Z512 is available in a 32 lead TSOP II (10 x 20mm) package.

Table 1. Signal Names

A0-A18	Address Inputs
DQ0-DQ7	Data Input/Output
$\overline{E}$	Chip Enable
$\overline{G}$	Output Enable
$\overline{W}$	Write Enable
V_{CC}	Supply Voltage
V_{SS}	Ground

Figure 1. Logic Diagram

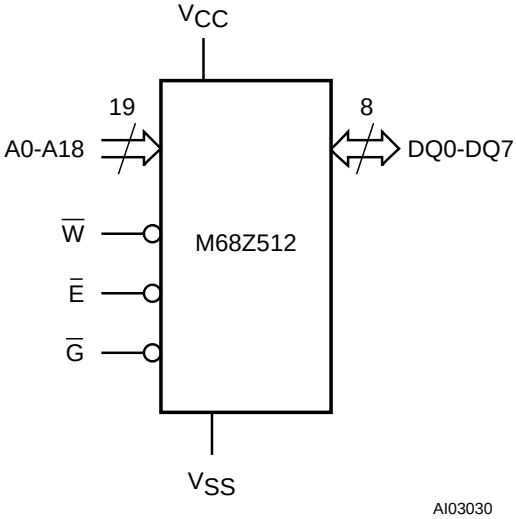
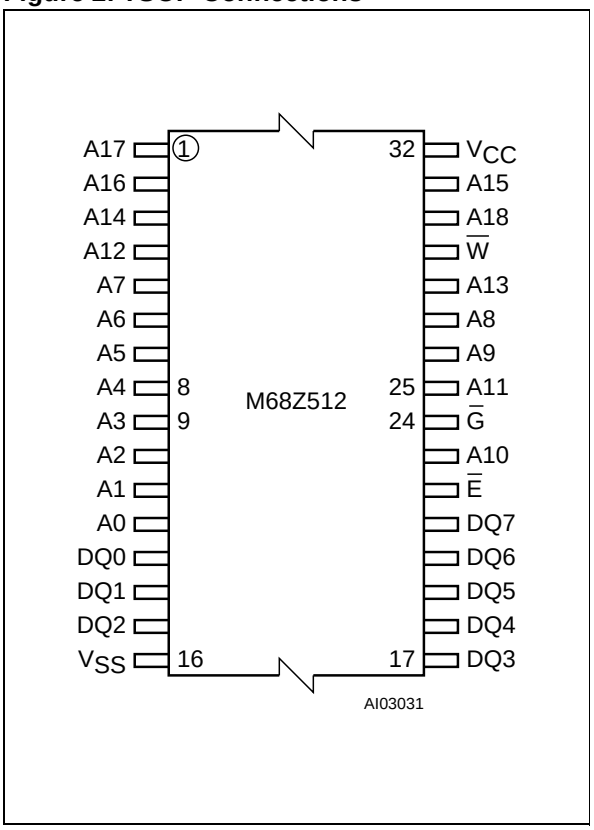


Table 2. Absolute Maximum Ratings (1)

Symbol	Parameter	Value	Unit
T_A	Ambient Operating Temperature	0 to 70	°C
T_{STG}	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 7.0	V
I_O (3)	Output Current	20	mA
P_D	Power Dissipation	1	W

Note: 1. Except for the rating "Operating Temperature Range", stresses above those listed in the Table "Absolute Maximum Ratings" 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.
2. Up to a maximum operating V_{CC} of 5.5V only.
3. One output at a time, not to exceed 1 second duration.

Figure 2. TSOP Connections



READ MODE

The M68Z512 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}.

WRITE MODE

The M68Z512 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 deasserted 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 ($\overline{E}$ = Low and $\overline{G}$ = 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}.

Table 3. Operating Modes

Operation	$\overline{E}$	$\overline{W}$	$\overline{G}$	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

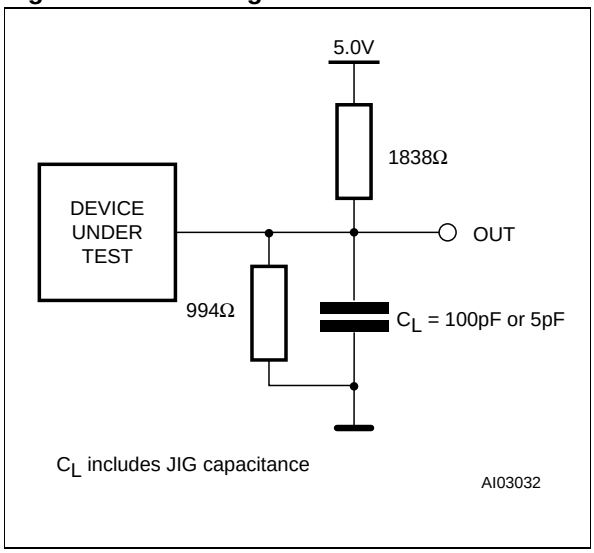
Note: 1. X = V_{IH} or V_{IL}.

Table 4. AC Measurement Conditions

Input Rise and Fall Times	≤ 5ns
Input Pulse Voltages	0 to 3V
Input and Output Timing Ref. Voltages	1.5V

Note: Output Hi-Z is defined as the point where data is no longer driven.

Figure 3. AC Testing Load Circuit



OPERATIONAL MODE

The M68Z512 has a Chip Enable power down feature which invokes an automatic standby mode whenever Chip Enable is de-asserted ($\overline{E}$ = High). An Output Enable ($\overline{G}$) 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 $\overline{W}$ and $\overline{E}$ as summarized in the Operating Modes table.

Table 5. Capacitance (1) (T_A = 25°C, f = 1 MHz)

Symbol	Parameter	Test Condition	Min	Max	Unit
C_{IN}	Input Capacitance on all pins (except DQ)	T_A = 25°C, f = 1MHz, V_{CC} = 5V		6	pF
C_{OUT} (2)	Output Capacitance	T_A = 25°C, f = 1MHz, V_{CC} = 5V		8	pF

Note: 1. Sampled only, not 100% tested.
2. Outputs deselected.

Figure 4. Block Diagram

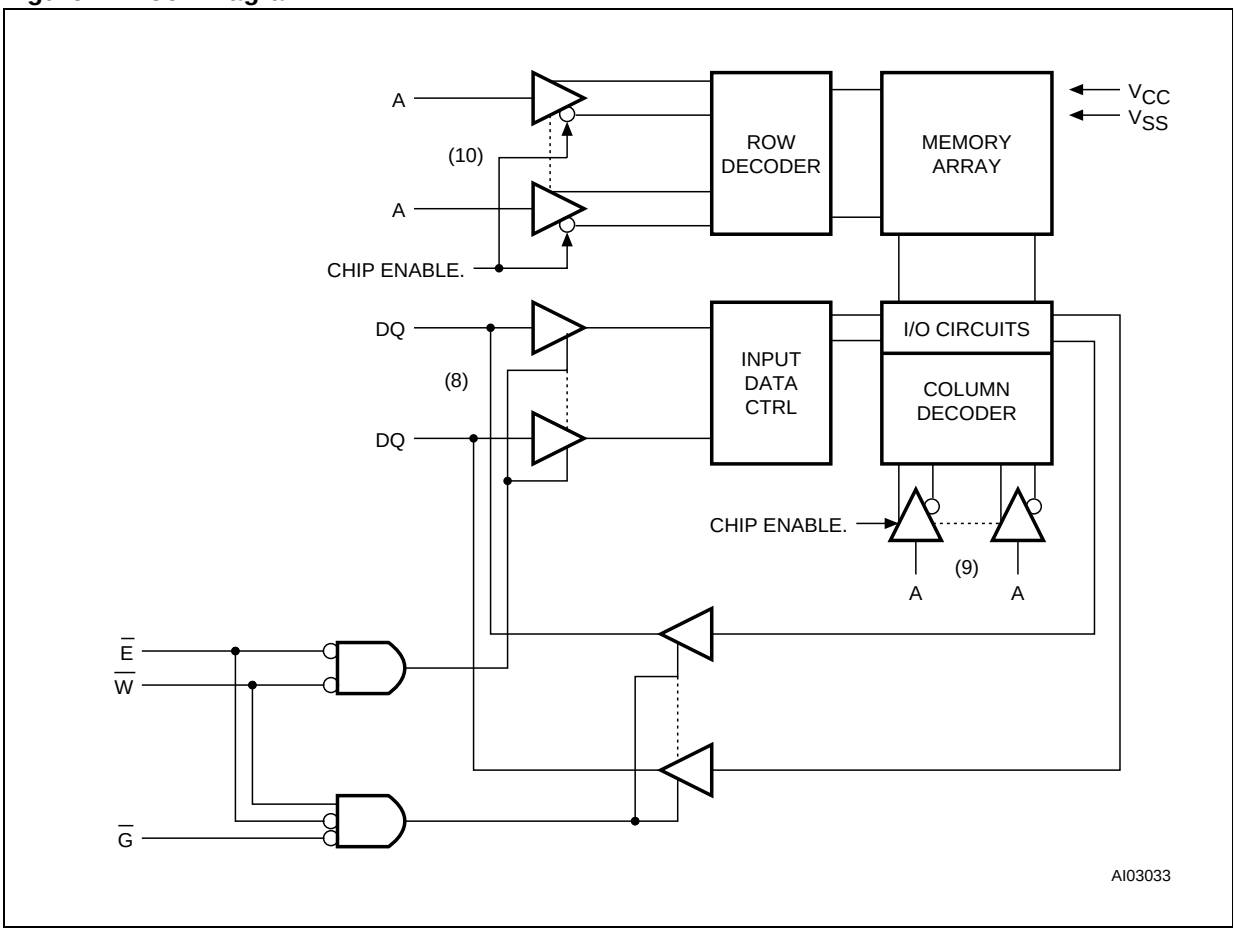


Table 6. DC Characteristics
(T_A = 0 to 70°C; V_{CC} = 5V ±10%)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
I_{LI}	Input Leakage Current	$0V \le V_{IN} \le V_{CC}$			±1	µA
I_{LO}	Output Leakage Current	$0V \le V_{OUT} \le V_{CC}$			±1	µA
I_{CC1} (1)	Supply Current	V_{CC} = 5.5V, (-55)			90	mA
I_{CC2} (2)	Supply Current (Standby) TTL	V_{CC} = 5.5V, $\overline{E}$ = V_{IH}			15	mA
I_{CC3} (3)	Supply Current (Standby) CMOS	V_{CC} = 5.5V, $\overline{E} \ge V_{CC}$ – 0.3V, f = 0		1.6	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

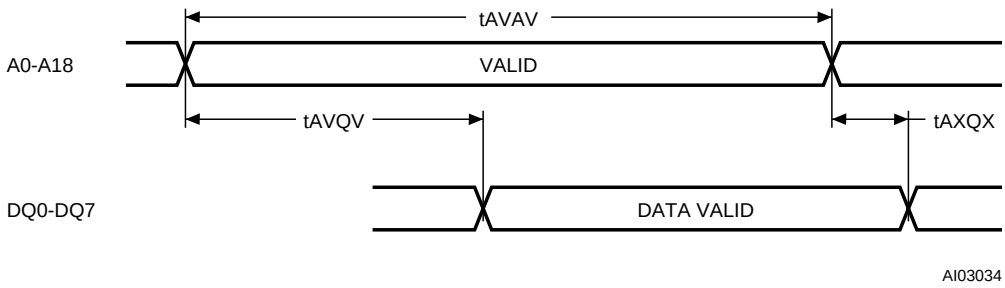
Note: 1. Average AC current, Outputs open, cycling at t_{AVAV} minimum.
2. All other Inputs at $V_{IL} \le 0.8V$ or $V_{IH} \ge 2.2V$.
3. All other Inputs at $V_{IL} \le 0.3V$ or $V_{IH} \ge V_{CC}$ –0.3V.

Table 7. Read and Standby Modes AC Characteristics
(T_A = 0 to 70°C; V_{CC} = 5V ±10%)

Symbol	Parameter	M68Z512		Unit
		-70		
		Min	Max	
t_{AVAV}	Read Cycle Time	70		ns
t_{AVQV} (1)	Address Valid to Output Valid		70	ns
t_{ELQV} (1)	Chip Enable Low to Output Valid		70	ns
t_{GLQV} (1)	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} (1)	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

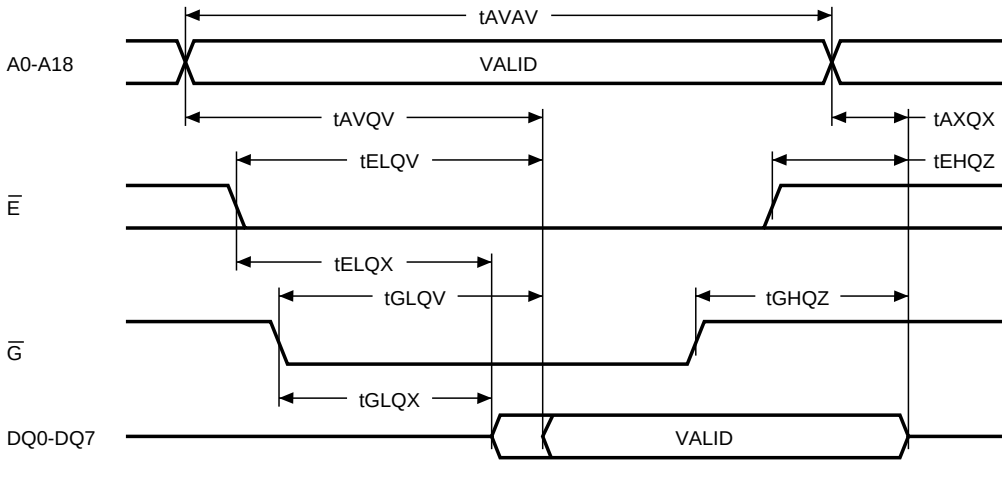
Note: 1. C_L = 100pF.
2. C_L = 5pF.
3. At any given temperature and voltage condition, t_{EHQZ} is less than t_{ELQX} and t_{GHQZ} is less than t_{GLQX} for any given device.

Figure 5. Address Controlled, Read Mode AC Waveforms



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

Figure 6. Chip Enable or Output Enable Controlled, Read Mode AC Waveforms.



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

Figure 7. Standby Mode AC Waveforms

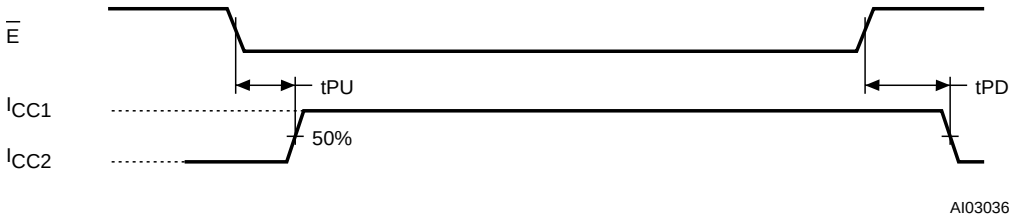
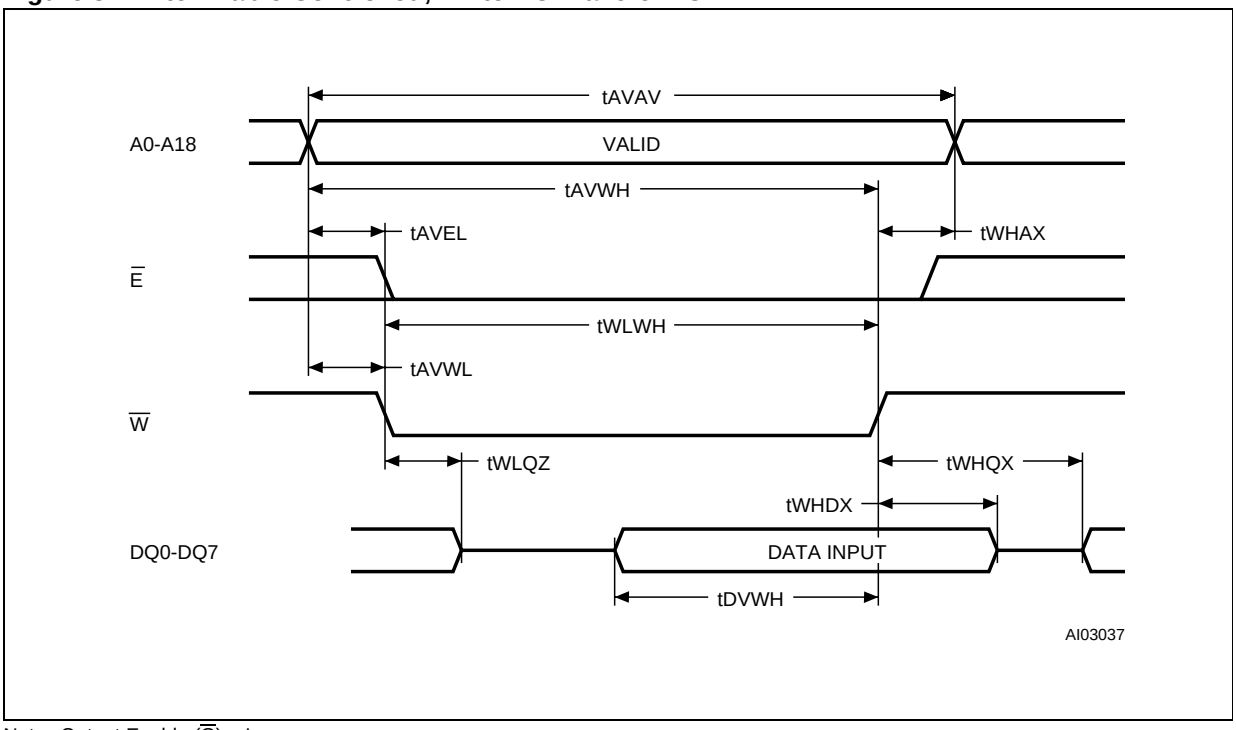


Table 8. Write Mode AC Characteristics
(T_A = 0 to 70°C; V_{CC} = 5V ±10%)

Symbol	Parameter	M68Z512		Unit
		-70		
		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	55		ns
t_{WHAX}	Write Enable High to Address Transition	0		ns
t_{WHDX}	Write Enable High to Input Transition	0		ns
t_{WHQX} (2)	Write Enable High to Output Transition	5		ns
t_{WLQZ} (1,2)	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	45		ns
t_{EHAX}	Chip Enable High to Address Transition	0		ns
t_{DVWH}	Input Valid to Write Enable High	25		ns
t_{DVEH}	Input Valid to Chip Enable High	25		ns

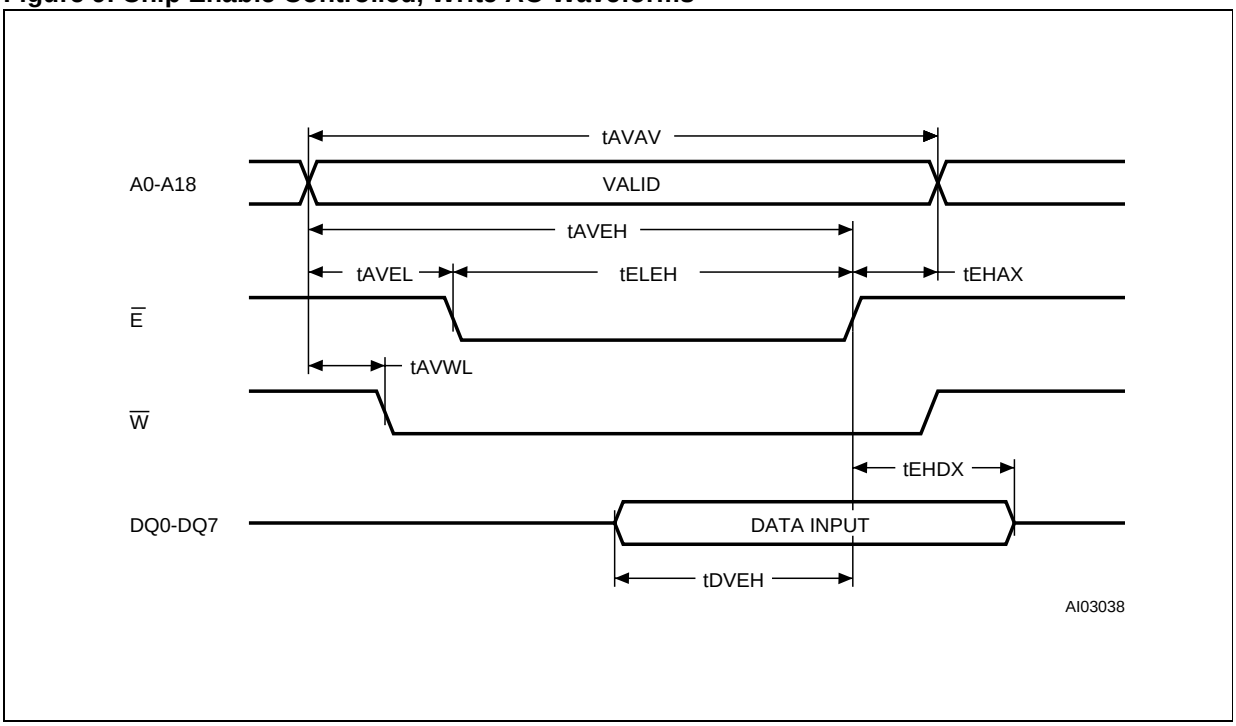
Note: 1. C_L = 5pF.
2. At any given temperature and voltage condition, t_{WLQZ} is less than t_{WHQX} for any given device.

Figure 8. Write Enable Controlled, Write AC Waveforms



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

Figure 9. Chip Enable Controlled, Write AC Waveforms (1,2)



Note: 1. Output Enable ($\overline{G}$) = High.
2. If $\overline{E}$ goes High with $\overline{W}$ high, the output remains in a high-impedance state.

Table 9. Low V_{CC} Data Retention Characteristics
(T_A = 0 to 70°C)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
I_{CCDR} (1)	Supply Current (Data Retention)	V_{CC} = 3V, $\overline{E} \geq V_{CC} - 0.3V$		0.1	10	µA
V_{DR}	Supply Voltage (Data Retention)	$\overline{E} \geq V_{CC} - 0.3V$, f = 0	2			V
t_{CDR}	Chip Disable to Power Down	$\overline{E} \geq V_{CC} - 0.3V$, f = 0	0			ns
t_{ER} (2)	Operation Recovery Time		t_{AVAV}			ns

Note: 1. Typical condition: T_A = 25°C.
2. See Figure 10 for measurement points. Guaranteed but not tested. t_{AVAV} is Read cycle time.

Figure 10. Low V_{CC} Data Retention AC Waveforms

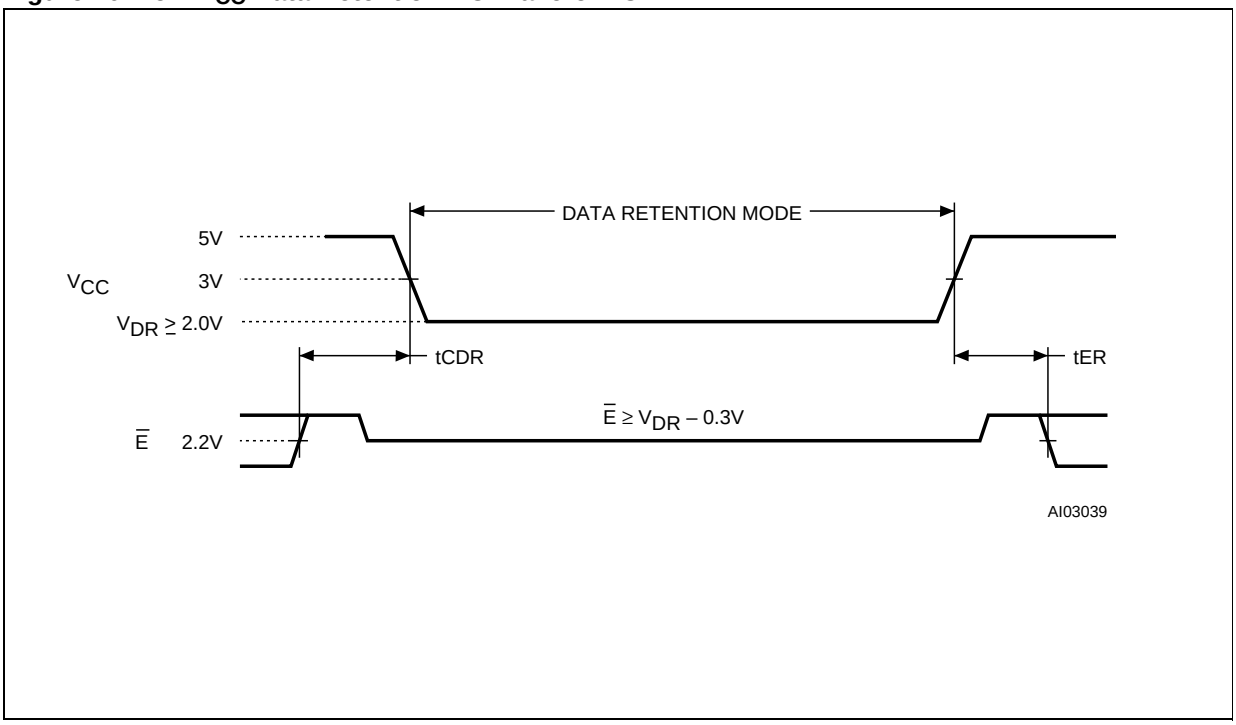
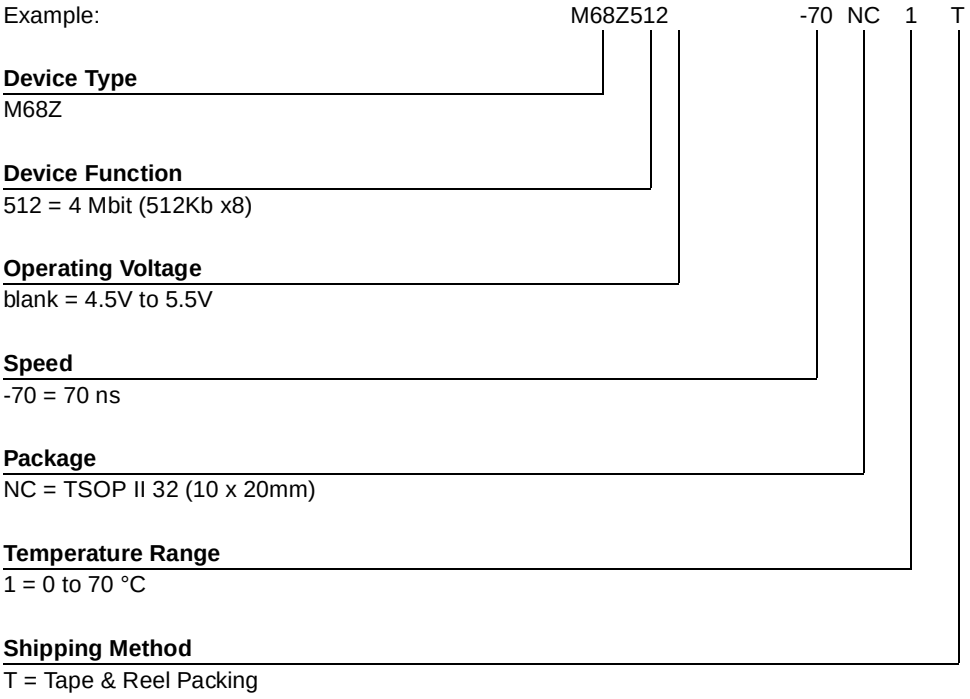


Table 10. Ordering Information Scheme



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

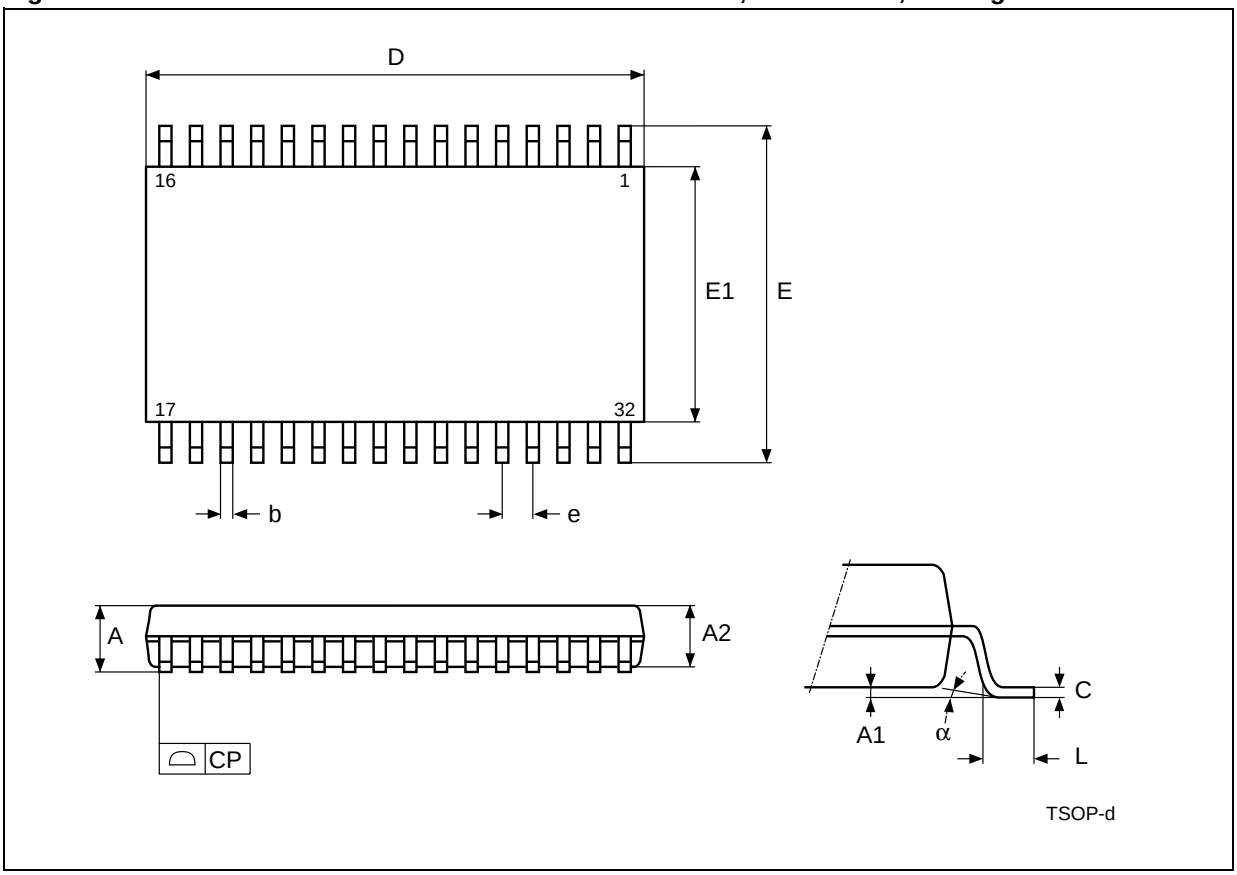
Table 11. Revision History

Date	Revision Details
May 1999	First Issue
03/14/00	TSOP32 II Package Dimension Changed (Table 12) From Preliminary Data to Data Sheet

Table 12. TSOP II 32 - 32 lead Plastic Thin Small Outline II, 10 x 20 mm, Package Mechanical Data

Symbol	mm			inch		
	Typ	Min	Max	Typ	Min	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
α		0°	5°		0°	5°
N	32			32		

Figure 11. TSOP II 32 - 32 lead Plastic Thin Small Outline II, 10 x 20 mm, Package Outline



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