

FEATURES

- Available in 100 and 120 ns (Max.) versions
- Automatic power-down when chip disabled
- Low power consumption (L-version):
 - 385mW (Max.) Operating
 - 11mW (Max.) Standby
 - 275 μ W (Max.) Power-down
- TTL compatible interface levels
- Single 5V power supply
- Fully static operation
- Three state outputs
- Chip enable for simple memory expansion
- Data retention as low as 2V

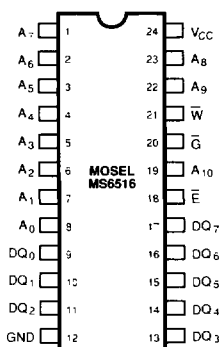
DESCRIPTION

The MOSEL MS6516 is a high performance, low power CMOS static RAM organized as 2048 words by 8 bits. The device supports easy memory expansion with an active LOW chip enable (\bar{E}) as well as an active LOW output enable (\bar{G}) and three-state outputs. An automatic power-down feature is included which reduces the chip power by 85% in TTL standby mode, and by over 99% in full power-down mode.

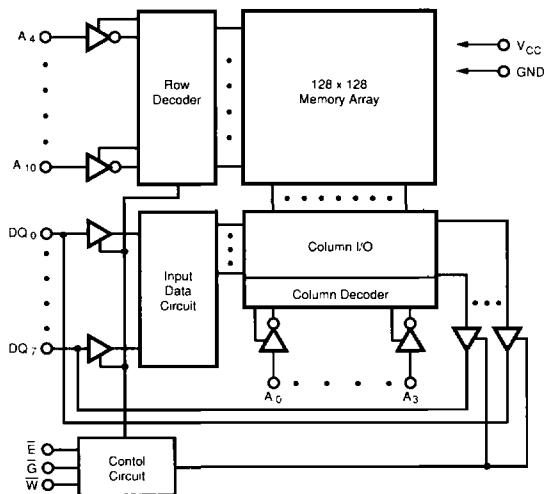
The device is manufactured in MOSEL's high performance CMOS process and operates from a single 5V power supply. All inputs and outputs are TTL compatible. Data is retained to as low as $V_{CC} = 2V$.

The MOSEL MS6516 is available in the JEDEC standard 24 pin 600 mil wide DIP and small outline package.

PIN CONFIGURATIONS



FUNCTIONAL BLOCK DIAGRAM



MS6516

PIN DESCRIPTIONS

$A_0 - A_{10}$ Address Inputs

These 11 address inputs select one of the 2048 8-bit words in the RAM.

\bar{E} Chip Enable Input

\bar{E} is active LOW. The chip enable must be active to read from or write to the device. If it is not active, the device is deselected and is in a standby power mode. The DQ pins will be in the high-impedance state when deselected.

\bar{G} Output Enable Input

The output enable input is active LOW. If the output enable is active while the chip is selected and the write enable is inactive, data will be present on the DQ pins and they will be enabled. The DQ pins will be in the high impedance state when \bar{G} is inactive.

\bar{W} Write Enable Input

The write enable input is active LOW and controls read and write operations. With the chip enabled, when \bar{W} is HIGH and \bar{G} is LOW, output data will be present at the DQ pins; when \bar{W} is LOW, the data present on the DQ pins will be written into the selected memory location.

$DQ_0 - DQ_7$ Data Input/Output Ports

These 8 bidirectional ports are used to read data from or write data into the RAM.

V_{CC} Power Supply

GND Ground

TRUTH TABLE

MODE	\bar{E}	\bar{G}	\bar{W}	I/O OPERATION
Standby	H	X	X	High Z
Read	L	L	H	D_{OUT}
Read	L	H	H	High Z
Write	L	X	L	D_{IN}

ABSOLUTE MAXIMUM RATINGS ⁽¹⁾

SYMBOL	PARAMETER		RATING	UNITS
$V_{CC} - GND$	Supply Voltage		-0.3 to 7	V
V_{IN}	Input Voltage		-0.3 to 7	
V_{IO}	Input/Output Voltage Applied		-0.3 to V_{CC} + 0.3	
T_{BIAS}	Temperature Under Bias	Plastic	-10 to +85	°C
T_{STG}	Storage Temperature	Plastic	-40 to +125	°C
P_D	Power Dissipation		1.0	W
I_{OUT}	DC Output Current		50	mA

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

OPERATING RANGE

RANGE	AMBIENT TEMPERATURE	V_{CC}
Commercial	0°C to +70°C	5V ± 10%

DC ELECTRICAL CHARACTERISTICS (over the commercial operating range)

PARAMETER NAME	PARAMETER	TEST CONDITIONS	MS6516L			MS6516S			UNITS
			MIN.	TYP. ⁽¹⁾	MAX.	MIN.	TYP. ⁽¹⁾	MAX.	
V_{IL}	Guaranteed Input Low Voltage ⁽²⁾		-0.3	-	+0.8	-0.3	-	+0.8	V
V_{IH}	Guaranteed Input High Voltage ⁽²⁾		2.2	-	$V_{CC} + 0.3$	2.2	-	$V_{CC} + 0.3$	V
I_{IL}	Input Leakage Current	$V_{CC} = \text{Max}, V_{IN} = 0V \text{ to } V_{CC}$	-	-	10	-	-	10	μA
I_{OL}	Output Leakage Current	$V_{CC} = \text{Max}, \bar{E} = V_{IH}, \text{ or } \bar{G} = V_{IH}, V_{IN} = 0V \text{ to } V_{CC}$	-	-	10	-	-	10	μA
V_{OL}	Output Low Voltage	$V_{CC} = \text{Min}, I_{OL} = 4\text{mA}$	-	0.21	0.4	-	0.21	0.4	V
V_{OH}	Output High Voltage	$V_{CC} = \text{Min}, I_{OH} = -1.0\text{mA}$	2.4	3.5	-	2.4	3.5	-	V
I_{CC}	Operating Power Supply Current	$V_{CC} = \text{Max}, \bar{E} = V_{IL}, I_{IO} = 0\text{mA}, F_{max}^{(3)}$	-	40	70	-	60	90	mA
I_{CCSB}	Standby Power Supply Current	$V_{CC} = \text{Max}, \bar{E} = V_{IH}, I_{IO} = 0\text{mA}$	-	0.5	2	-	2	10	mA
I_{CCSB1}	Power Down Power Supply Current	$V_{CC} = \text{Max}, \bar{E} > V_{CC} - 0.2V, \bar{G} > V_{CC} - 0.2V, V_{IN} > V_{CC} - 0.2V \text{ or } V_{IN} < 0.2V$	-	1	10	-	10	100	μA

- Typical characteristics are at $V_{CC} = 5V, T_A = 25^\circ\text{C}$.
- These are absolute values with respect to device ground and all overshoots due to system or tester noise are included.
- $F_{max} = 1/t_{RC}$

CAPACITANCE⁽¹⁾ ($T_A = 25^\circ\text{C}, f = 1.0\text{MHz}$)

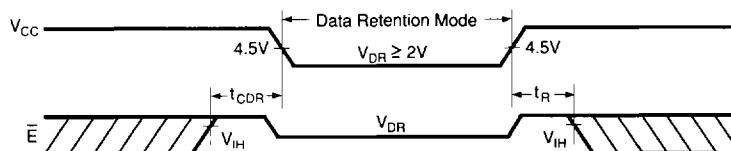
SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
C_{IN}	Input Capacitance	$V_{IN} = 0V$	8	pF
C_{IO}	Input/Output Capacitance	$V_{IO} = 0V$	10	pF

- This parameter is guaranteed and not tested.

DATA RETENTION CHARACTERISTICS (over the commercial operating range)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP. ⁽²⁾	MAX. ⁽³⁾	UNITS
V_{DR}	V_{CC} for Data Retention	$\bar{E} = V_{CC}$	2.0	-	-	V
I_{CCDR}	Data Retention Current	$V_{IN} = 0V \text{ or } V_{CC}$	-	2	10	μA
t_{CDR}	Chip Deselect to Data Retention Time	$V_{CC} = 2.0V, \bar{E} = V_{CC}$	0	-	-	ns
t_R	Operation Recovery Time	$V_{IN} = 0V \text{ or } V_{CC}$	$t_{RC}^{(2)}$	-	-	ns

- $V_{CC} = 2V, T_A = +25^\circ\text{C}$
- t_{RC} = Read Cycle Time

TIMING WAVEFORM LOW V_{CC} DATA RETENTION WAVEFORM

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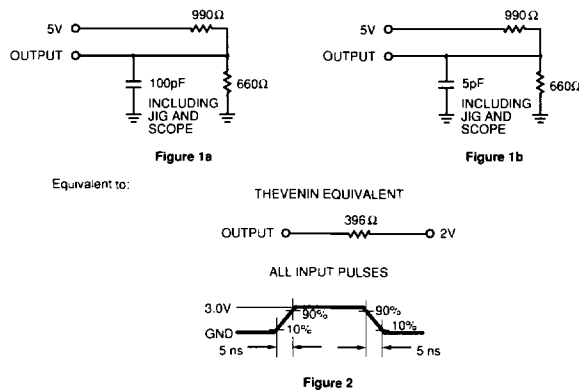
AC TEST CONDITIONS

Input Pulse Levels	0V to 3.0V
Input Rise and Fall Times	5ns
Input and Output	1.5V
Timing Reference Level	

KEY TO SWITCHING WAVEFORMS

WAVEFORM	INPUTS	OUTPUTS
	MUST BE STEADY	WILL BE STEADY
	MAY CHANGE FROM H TO L	WILL BE CHANGING FROM H TO L
	MAY CHANGE FROM L TO H	WILL BE CHANGING FROM L TO H
	DON'T CARE: ANY CHANGE PERMITTED	CHANGING: STATE UNKNOWN
	DOES NOT APPLY	CENTER LINE IS HIGH IMPEDANCE "OFF" STATE

AC TEST LOADS AND WAVEFORMS



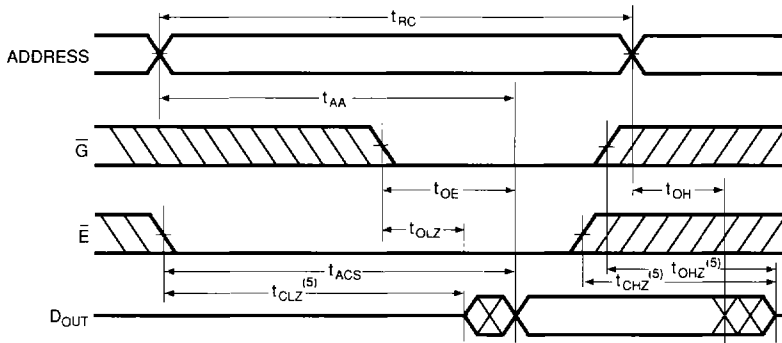
AC ELECTRICAL CHARACTERISTICS (over the commercial operating range)

READ CYCLE

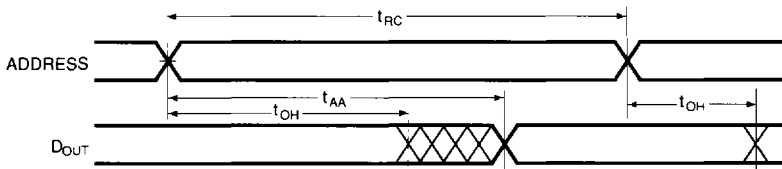
JEDEC PARAMETER NAME	PARAMETER NAME	PARAMETER	-10		-12		UNIT
			MIN.	MAX.	MIN.	MAX.	
t_{AVAX}	t_{RC}	Read Cycle Time	100	-	120	-	ns
t_{AVQV}	t_{AA}	Address Access Time	-	100	-	120	ns
t_{ELQV}	t_{ACS}	Chip Enable Access Time	-	100	-	120	ns
t_{GLOV}	t_{OE}	Output Enable to Output Valid	-	50	-	50	ns
t_{ELOX}	t_{CLZ}	Chip Enable to Output Low Z	5	-	10	-	ns
t_{GLOX}	t_{OLZ}	Output Enable to Output in Low Z	5	-	10	-	ns
t_{EHQZ}	t_{CHZ}	Chip Disable to Output in High Z	0	40	0	40	ns
t_{GHQZ}	t_{OHZ}	Output Disable to Output in High Z	0	35	0	40	ns
t_{AXQX}	t_{OH}	Output Hold from Address Change	5	-	10	-	ns

SWITCHING WAVEFORMS (READ CYCLE)

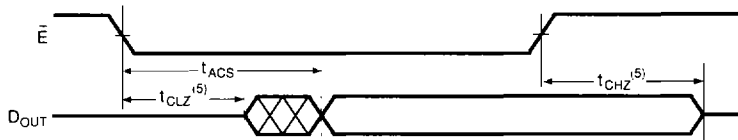
READ CYCLE 1⁽¹⁾



READ CYCLE 2^(1, 2, 4)



READ CYCLE 3^(1, 3, 4)



NOTES:

1. \bar{W} is High for READ Cycle.
2. Device is continuously selected $\bar{E} = V_{IL}$.
3. Address valid prior to or coincident with \bar{E} transition low.
4. $\bar{G} = V_{IL}$.
5. Transition is measured $\pm 500\text{mV}$ from steady state with $C_L = 5\text{pF}$ as shown in Figure 1b on page 4. This parameter is guaranteed and not 100% tested.

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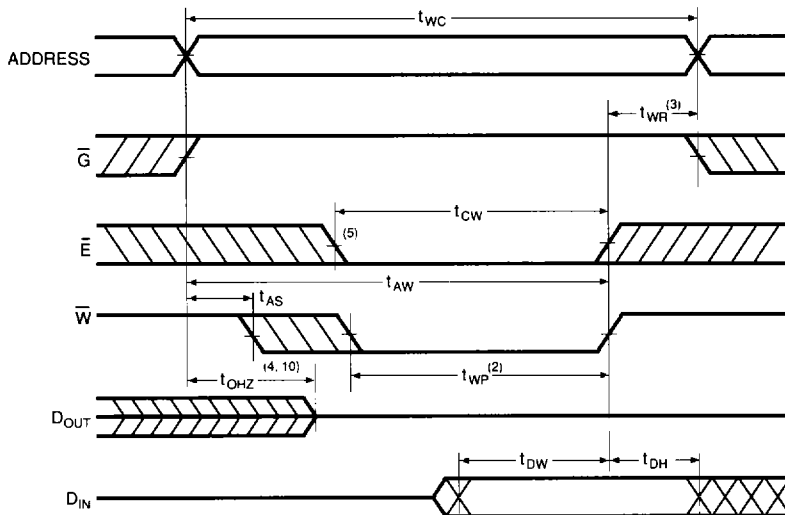
AC ELECTRICAL CHARACTERISTICS (over the commercial operating range)

WRITE CYCLE

JEDEC PARAMETER NAME	PARAMETER NAME	PARAMETER	-10		-12		UNIT
			MIN.	MAX.	MIN.	MAX.	
t_{AVAX}	t_{WC}	Write Cycle Time	100	-	120	-	ns
t_{ELWH}	t_{CW}	Chip Enable to End of Write	55	-	70	-	ns
t_{AVWL}	t_{AS}	Address Set up Time	0	-	0	-	ns
t_{AVWH}	t_{AW}	Address Valid to End of Write	80	-	85	-	ns
t_{WLWH}	t_{WP}	Write Pulse Width	50	-	70	-	ns
t_{WHAX}	t_{WR}	Write Recovery Time	0	-	0	-	ns
t_{WLOZ}	t_{WHZ}	Write to Output in High Z	-	35	-	50	ns
t_{DVWH}	t_{DW}	Data Valid to End of Write	30	-	35	-	ns
t_{WHDX}	t_{DH}	Data Hold from Write Time	0	-	0	-	ns
t_{GHZO}	t_{OHZ}	Output Disable to Output in High Z	0	35	0	40	ns
t_{WHQX}	t_{OW}	Output Active from End of Write	0	-	5	-	ns

SWITCHING WAVEFORMS (WRITE CYCLE)

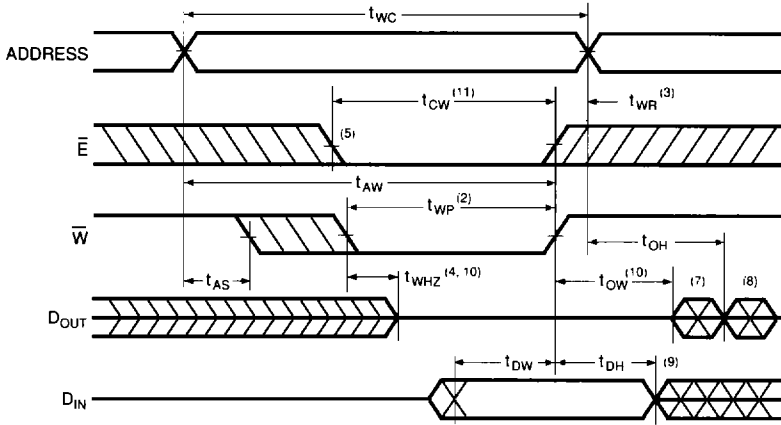
WRITE CYCLE 1⁽¹⁾



SWITCHING WAVEFORMS (WRITE CYCLE)

WRITE CYCLE 2^(1,6)

2



NOTES:

1. \bar{W} must be high during address transitions.
2. The internal write time of the memory is defined by the overlap \bar{E} active and \bar{W} low. Both signals must be active to initiate and any one signal can terminate a write by going inactive. The data input setup and hold timing should be referenced to the second transition edge of the signal that terminates the write.
3. t_{WR} is measured from the earlier of \bar{E} or \bar{W} going high at the end of write cycle.
4. During this period, DQ pins are in the output state so that the input signals of opposite phase to the outputs must not be applied.
5. If the \bar{E} low transition occurs simultaneously with the \bar{W} low transitions or after the \bar{W} low transition, outputs remain in a high impedance state.
6. \bar{G} is continuously low ($\bar{G} = V_L$).
7. D_{OUT} is the same phase of write data of this write cycle.
8. D_{OUT} is the read data of next address.
9. If \bar{E} is low during this period, DQ pins are in the output state. Then the data input signals of opposite phase to the outputs must not be applied to them.
10. Transition is measured ± 500 mV from steady state with $C_L = 5$ pF as shown in Figure 1b on page 4. This parameter is guaranteed and not 100% tested.
11. t_{CW} is measured from \bar{E} going low to the end of write.

ORDERING INFORMATION

SPEED (ns)	ORDERING PART NUMBER	PACKAGE REFERENCE NO.	TEMPERATURE RANGE
100	MS6516L-10PC	P24-1	0°C to +70°C
100	MS6516S-10PC		0°C to +70°C
120	MS6516S-12SC	S24-1	0°C to +70°C