OKI semiconductor

MSM5165LRS/JS

8,192-WORD x 8-BIT CMOS STATIC RAM (E3-S-017-32)

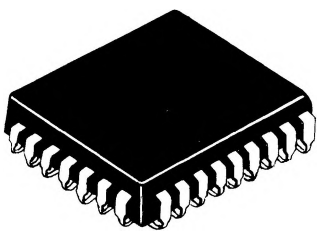
GENERAL DESCRIPTION

The MSM5165LRS/JS is a 8192-word by 8-bit CMOS static RAM featuring 5V power supply operation and direct TTL input/output compatibility. Since the circuitry is completely static, external clock and refreshing operations are unnecessary, making this device very easy to use. The MSM5165LRS/JS is also a CMOS silicon gate device which requires very low power during standby (standby current of 100μA) when there is no chip selection.

A byte system is adopted, and since there is pin compatibility with standard ultra-violet EPROMs, this device is ideal for use as a peripheral memory for microcomputers and data terminal units etc. In addition, CE_1 CE_2 and OE signals enable OR ties with the output terminals of other chips, thereby facilitating simple memory expansion and bus line control etc.

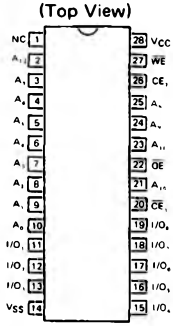
FEATURES

- Single 5V Supply
- 0°C ~ 70°C
- Low Power Dissipation
  - Standby; 0.55 mW MAX
  - Operation; 248 mW MAX
- High Speed (Equal Access and Cycle Time)
  - 120 – 200 ns MAX
- Direct TTL Compatible. (Input and Output)
- 3-State Output
- Pin Compatible with
  - 64K EPROM (MSM2764)
- 28-pin DIP PKG
- 32-pin PLCC



PIN CONFIGURATION

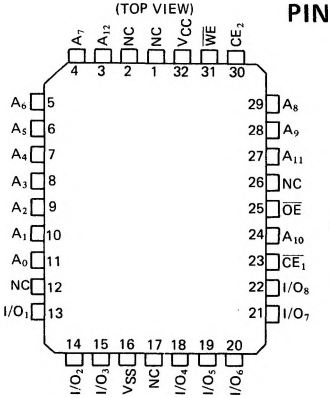
(Top View)



$A_0 \sim A_{12}$: Address INPUTS
$I/O_1 \sim I/O_8$: Data Input/Output
$\overline{CE}_1$, CE_2 : Chip Select
$\overline{WE}$: Write Enable
$\overline{OE}$: Output Enable
V_{CC}, V_{SS} : Supply Voltage

PIN CONFIGURATION

(TOP VIEW)



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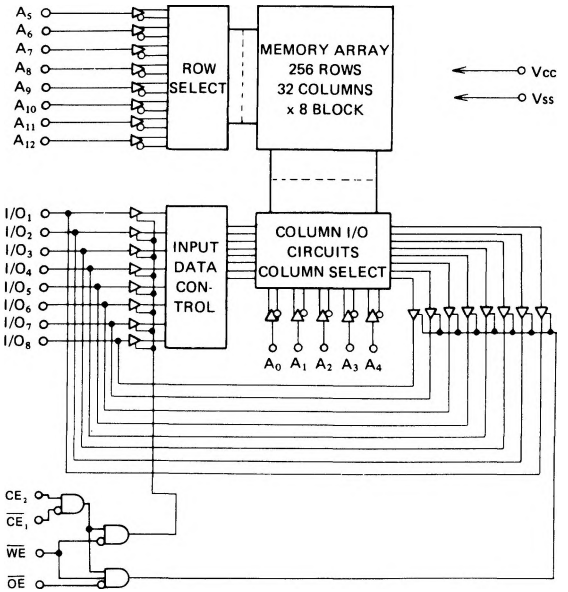
FUNCTIONAL BLOCK DIAGRAM



TRUTH TABLE

Mode	$\overline{CE_1}$	CE_2	$\overline{WE}$	$\overline{OE}$	I/O Operation
Standby	H	X	X	X	High Z
	X	L	X	X	
Read	L	H	H	H	High Z
	L	H	H	L	D_{OUT}
Wreite	L	H	L	X	D_{IN}

X : H or L

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit	Conditions
Supply Voltage	V_{CC}	−0.3 to 7.0	V	Respect to GND
Input Voltage	V_{IN}	−0.3 to V_{CC} + 0.3	V	
Operating Temperature	T_{opr}	0 to 70	°C	
Storage Temperature	T_{stg}	−55 to 150	°C	
Power Dissipation	P_D	1.0	W	Ta = 25°C

RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	V_{CC}	4.5	5	5.5	V	5V ± 10%
	V_{SS}		0		V	
Data Retention Voltage	V_{CCH}	2	5	5.5	V	
Input Voltage	V_{IH}	2.2		V_{CC} + 0.3	V	5V ± 10%
	V_{IL}	−0.3		0.8	V	
Output Load	C_L			100	pF	
	TTL			1		

DC CHARACTERISTICS

(V_{CC} = 5V ±10%, T_a = 0°C to +70°C)

Paramter	Symbol	MSM5165L			Unit	Test Condition
		Min.	Typ.	Max.		
Input Leakage Current	I_{LI}	−1		1	μA	V_{IN} = 0 to V_{CC}
Output Leakage Current	I_{LO}	−1		1	μA	$\overline{CE}_1$ = V_{IH} or CE_2 = V_{IL} or $\overline{OE}$ = V_{IH} $V_{I/O}$ = 0 to V_{CC}
Output Voltage	V_{OH}	2.4			V	I_{OH} = −1 mA
	V_{OL}			0.4	V	I_{OL} = 2.1 mA
Standby Supply Current	I_{CCS}		2	100	μA	$\overline{CE}_1 \geqq V_{CC} - 0.2V$, $CE_2 \geqq V_{CC} - 0.2V$ or V_{IN} = 0 to V_{CC}
						$CE_2 \leqq 0.2V$ V_{IN} = 0 to V_{CC}
	I_{CCS1}			3	mA	$\overline{CE}_1$ = V_{IH}, CE_2 = V_{IL} t_{cyc} = Min. cycle
Operating Supply Current	I_{CCA}			①	mA	T_{CYC} = Min. cycle
				15		T_{CYC} = 1 μs

AC CHARACTERISTICS

Test Condition

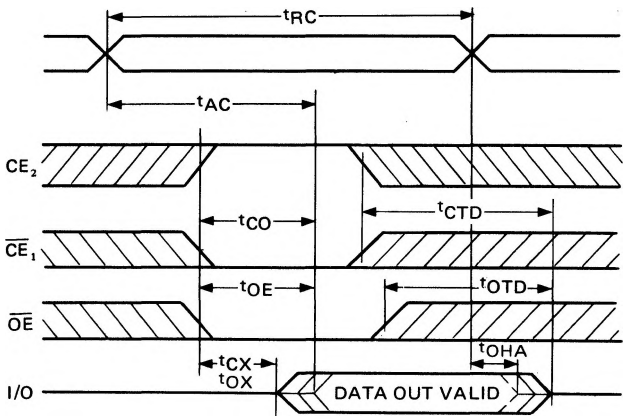
Parameter	Conditions
Input Pulse Level	V_{IH}=2.4V, V_{IL}=0.6V
Input Rise and Fall Times	10 ns
Input and Output Timing Reference Level	1.5V
Output Load	C_L=100 pF, 1 TTL Gate

READ CYCLE

(V_{CC} = 5V ± 10%, T_a = 0°C to 70°C)

Parameter	Symbol	MSM5165-12		MSM5165-15		MSM5165-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Read Cycle Time	t_{RC}	120		150		200		ns
Address Access Time	t_{AC}		120		150		200	ns
Chip Enable Access Time	t_{CO}		120		150		200	ns
Output Enable to Output Valid	t_{OE}		60		70		90	ns
Chip Selection to Output Active	t_{CX}	10		10		10		ns
Output Hold Time From Address Change	t_{OHA}	10		15		20		ns
Output Enable to Output Active	t_{OX}	5		5		5		ns
Output 3-state from Output Disable	t_{OTD}	0	40	0	50	0	60	ns
Output 3-state from Chip Deselection	t_{CTD}	0	60	0	70	0	80	ns

READ CYCLE



Notes: 1. A Read occurs during the overlap of a low $\overline{CE}_1$, a high CE_2, a low $\overline{OE}$ and a high $\overline{WE}$.
2. t_{CX} is specified from $\overline{CE}_1$, CE_2 or $\overline{OE}$, whichever occurs last.
3. t_{OTD} is specified from $\overline{CE}_1$, CE_2 or $\overline{OE}$, whichever occurs first.
4. t_{OHA} and t_{OTD} are specified by the time when DATA OUT is floating.

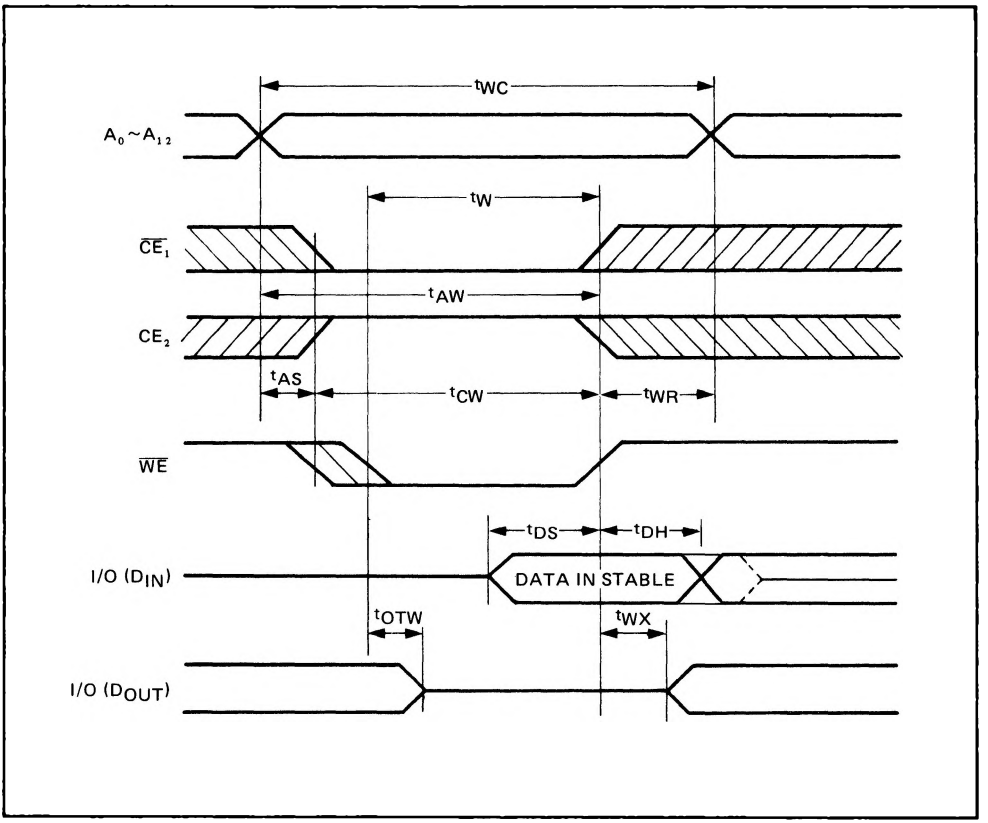
WRITE CYCLE

(V_{CC} = 5V ± 10%, T_a = 0°C to +70°C)

Item	Symbol	MSM5165L-12		MSM5165L-15		MSM5165L-20		Unit
		Min.	Max.	Min.	Max.	Min.	Max.	
Write Cycle Time	t_{WC}	120		150		200		ns
Address to Write Setup Time	t_{AS}	0		0		0		ns
Write Time	t_W	70		90		120		ns
Write Recovery Time	t_{WR}	15		15		15		ns
Data Setup Time	t_{DS}	50		60		80		ns
Data Hold from Write Time	t_{DH}	0		0		0		ns
Output 3-State from Write	t_{OTW}	0	40	0	50	0	60	ns
Chip Selection to End of Write	t_{CW}	100		120		150		ns
Address Valid to End of Write	t_{AW}	100		120		150		ns
Output Active from End of Write	t_{WX}	5		5		5		ns

Notes: 1. A Write Cycle occurs during the overlap of a low $\overline{CE}_1$, a high CE_2 and a low $\overline{WE}$.
2. OE may be both high and low in a Write Cycle.
3. t_{AS} is specified from $\overline{CE}_1$, CE_2 or $\overline{WE}$, whichever occurs last.
4. t_W is an overlap time of a low $\overline{CE}_1$, a high CE_2 and a low $\overline{WE}$.
5. t_{WR}, t_{DS} and t_{DH} are specified from $\overline{CE}_1$, CE_2 or $\overline{WE}$, whichever occurs first.
6. t_{OTW} is specified by the time when DATA OUT is floating, not defined by output level.
7. When I/O pins are Data output mode, don't force inverse signal to those pins.

WRITE CYCLE

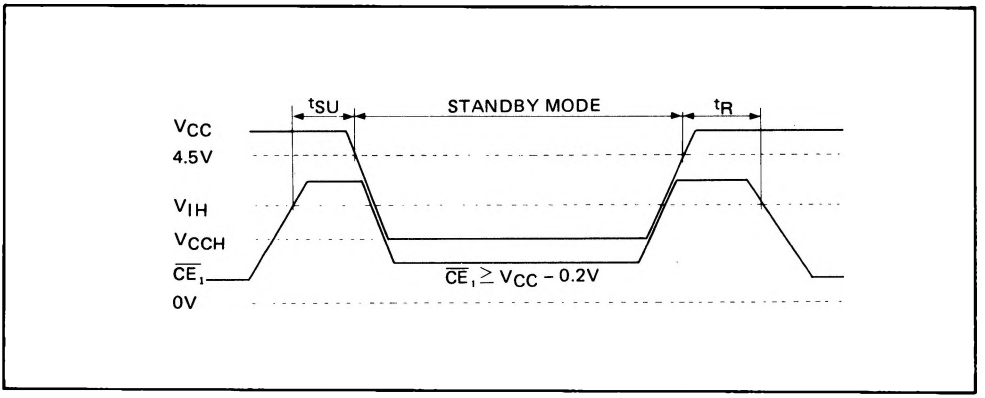


LOW V_{CC} DATA RETENTION CHARACTERISTICS

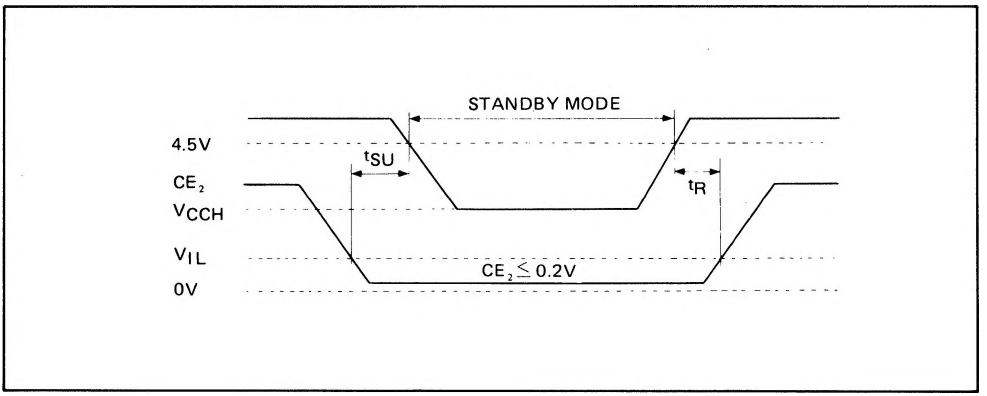
(T_a = 0°C to +70°C, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
V_{CC} for Data Retention	V_{CCH}	2			V	$\overline{CE}_1 \geq V_{CC} - 0.2V$, $CE_2 \geq V_{CC} - 0.2V$
						$CE_2 \leq 0.2V$
Data Retention Current	I_{CCH}		1	50	μA	V_{CC} = 3V, $\overline{CE}_1 \geq V_{CC} - 0.2V$, $CE_2 \geq V_{CC} - 0.2V$
						V_{CC} = 3V, $CE_2 \leq 0.2V$
CS to Data Retention Time	t_{SU}	0			ns	
Operation Recovery Time	t_R	t_{RC}			ns	

$\overline{CE_1}$ CONTROL



CE_2 CONTROL



CAPACITANCE

(Ta = 25°C, f = 1MHz)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input/Output Capacitance	$C_{I/O}$			8	pF
Input Capacitance	C_{IN}			6	pF

Note: This parameter is periodically sampled and not 100% tested.