SRAM

256K x 4 SRAM

REVOLUTIONARY PINOUT, 3.3V
OPERATION WITH SINGLE CHIP ENABLE

FEATURES

- All I/O pins are 5V tolerant
- High speed: 12*, 15, 20 and 25ns
- Multiple center power and ground pins for greater noise immunity
- Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ options
- Automatic $\overline{CE}$ power down
- All inputs and outputs are TTL-compatible
- High-performance, low-power, CMOS double-metal process
- Single +3.3V ±0.3V power supply
- Fast $\overline{OE}$ access times: 8, 10 and 12ns
- Complies to JEDEC low-voltage TTL standards

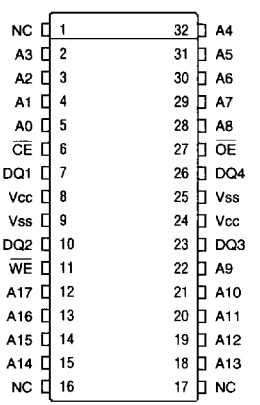
OPTIONS	MARKING
• Timing	
12ns access	-12*
15ns access	-15
20ns access	-20
25ns access	-25
• Packages	
32-pin SOJ (400 mil)	DJ
• 2V data retention (optional)	L
• Temperature	
Commercial (0°C to +70°C)	None

- Part Number Example: MT5LC256K4D4DJ-20 L

*Consult the factory for availability.

PIN ASSIGNMENT (Top View)

32-Pin SOJ
(SD-5)



GENERAL DESCRIPTION

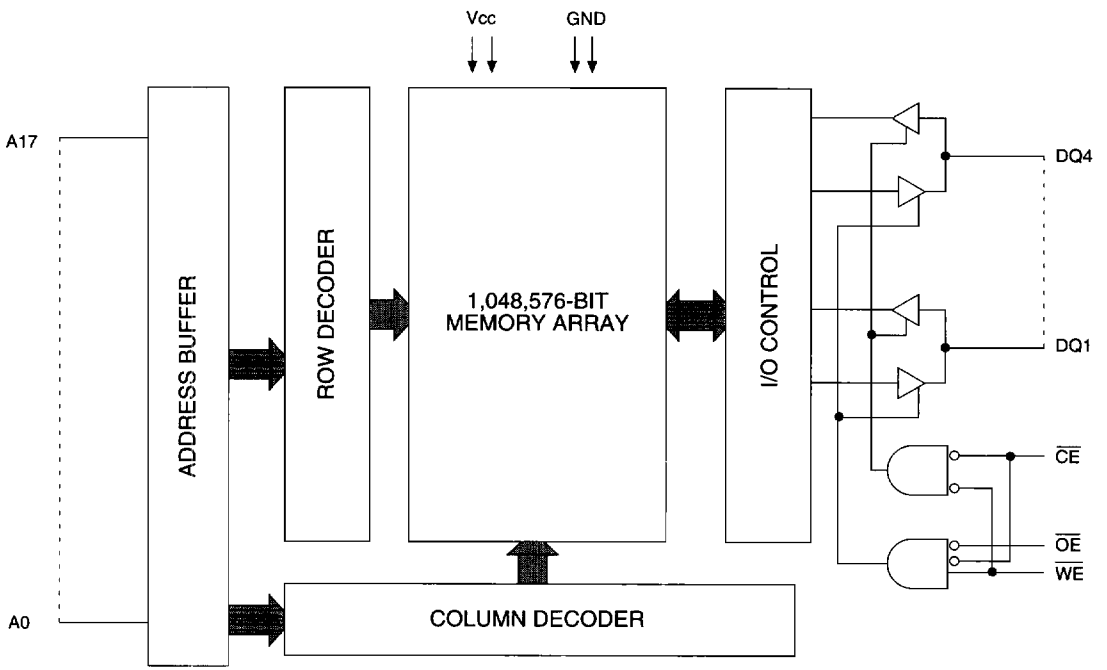
The MT5LC256K4D4 is organized as a 262,144 x 4 SRAM using a four-transistor memory cell with a high-speed, low-power CMOS process. Micron SRAMs are fabricated using double-layer metal, double-layer polysilicon technology.

This device offers multiple center power and ground pins for improved performance. For flexibility in high-speed memory applications, Micron offers chip enable ($\overline{CE}$) and output enable ($\overline{OE}$) capability. This enhancement can place the outputs in High-Z for additional flexibility in system design.

Writing to these devices is accomplished when write enable ($\overline{WE}$) and $\overline{CE}$ inputs are both LOW. Reading is accomplished when $\overline{WE}$ remains HIGH while output enable ($\overline{OE}$) and $\overline{CE}$ are LOW. The device offers a reduced power standby mode when disabled. This allows system designers to achieve their low standby power requirements.

All devices operate from a single +3.3V power supply and all inputs and outputs are fully TTL-compatible. These 3.3V devices are ideal for 3.3V-only and mixed 3.3V and 5V systems. All input pins and bidirectional pins are 5V-tolerant, meaning that 5V devices can directly drive these devices without increased current or any damaging effects. Refer to Technical Note TN-05-16 for further information.

FUNCTIONAL BLOCK DIAGRAM



TRUTH TABLE

MODE	$\overline{OE}$	$\overline{CE}$	$\overline{WE}$	DQ	POWER
STANDBY	X	H	X	HIGH-Z	STANDBY
READ	L	L	H	Q	ACTIVE
NOT SELECTED	H	L	H	HIGH-Z	ACTIVE
WRITE	X	L	L	D	ACTIVE

PIN DESCRIPTIONS

SOJ AND TSOP PIN NUMBERS	SYMBOL	TYPE	DESCRIPTION
5, 4, 3, 2, 32, 31, 30, 29, 28, 22, 21, 20, 19, 18, 15, 14, 13, 12	A0-A17	Input	Address Inputs: These inputs determine which cell is addressed.
11	$\overline{WE}$	Input	Write Enable: This input determines if the cycle is a READ or WRITE cycle. $\overline{WE}$ is LOW for a WRITE cycle and HIGH for a READ cycle.
6	$\overline{CE}$	Input	Chip Enable: This active LOW input is used to enable the device. When $\overline{CE}$ is HIGH, the chip is disabled and automatically goes into standby power mode.
27	$\overline{OE}$	Input	Output Enable: This active LOW input enables the output drivers.
7, 10, 23, 26	DQ1-DQ4	Input/ Output	SRAM Data I/O: Data inputs and tristate data outputs.
8, 24	Vcc	Supply	Power Supply: 3.3V ±0.3V
9, 25	Vss	Supply	Ground: GND
1, 16, 17	NC	-	No Connect: These signals are not internally connected.

ABSOLUTE MAXIMUM RATINGS*

Voltage on V_{CC} Supply Relative to Vss ..... -0.5V to +4.6V
V_{IN} ..... -0.5V to +6.0V
Storage Temperature (plastic) ..... -55°C to +150°C
Power Dissipation 1W
Short Circuit Output Current 50mA

*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. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED DC OPERATING CONDITIONS

($0°C \le T_A \le 70°C$; $V_{CC} = 3.3V \pm 0.3V$)

DESCRIPTION	CONDITIONS	SYMBOL	MIN	MAX	UNITS	NOTES
Input High (Logic 1) Voltage		V_{IH}	2.0	5.5	V	1, 2
Input Low (Logic 0) Voltage		V_{IL}	-0.3	0.8	V	1, 2
Input Leakage Current	$0V \le V_{IN} \le V_{CC}$	I_{LI}	-1	1	µA	
Output Leakage Current	Output(s) disabled $0V \le V_{OUT} \le V_{CC}$	I_{LO}	-1	1	µA	
Output High Voltage	I_{OH} = -4.0mA	V_{OH}	2.4		V	1
Output Low Voltage	I_{OL} = 8.0mA	V_{OL}		0.4	V	1
Supply Voltage		V_{CC}	3.0	3.6	V	1

				MAX					
DESCRIPTION	CONDITIONS	SYMBOL	TYP	-12	-15	-20	-25	UNITS	NOTES
Power Supply Current: Operating	$\overline{CE} \le V_{IL}$; V_{CC} = MAX f = MAX = 1/ ^tRC outputs open	I_{CC}	165	280	230	180	160	mA	3, 15
Power Supply Current: Standby	$\overline{CE} \ge V_{IH}$; V_{CC} = MAX f = MAX = 1/ ^tRC outputs open	I_{SB1}	35	60	50	40	35	mA	15
	$\overline{CE} \ge V_{CC}$ -0.2V; V_{CC} = MAX $V_{IN} \le V_{SS}$ +0.2V or $V_{IN} \ge V_{CC}$ -0.2V; f = 0	I_{SB2}	0.5	5	5	5	5	mA	15

CAPACITANCE

DESCRIPTION	CONDITIONS	SYMBOL	MAX	UNITS	NOTES
Input Capacitance	T_A = 25°C; f = 1 MHz	C_I	5	pF	4
Output Capacitance	V_{CC} =3.3V	C_O	5	pF	4

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

(Note 5, 13, 15) ($0°C \le T_A \le 70°C$)

DESCRIPTION		-12		-15		-20		-25			
	SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS	NOTES
READ Cycle											
READ cycle time	^tRC	12		15		20		25		ns	
Address access time	^tAA		12		15		20		25	ns	
Chip Enable access time	^tACE		12		15		20		25	ns	
Output hold from address change	^tOH	3		4		4		4		ns	
Chip Enable to output in Low-Z	^tLZCE	4		5		5		5		ns	7
Chip disable to output in High-Z	^tHZCE		6		6		8		8	ns	6, 7
Chip Enable to power-up time	^tPU	0		0		0		0		ns	
Chip disable to power-down time	^tPD		12		15		20		25	ns	
Output Enable access time	^tAOE		6		8		10		12	ns	
Output Enable to output in Low-Z	^tLZOE	0		0		0		0		ns	
Output disable to output in High-Z	^tHZOE		6		6		8		8	ns	6
WRITE Cycle											
WRITE cycle time	^tWC	12		15		20		25		ns	
Chip Enable to end of write	^tCW	10		12		13		15		ns	
Address valid to end of write	^tAW	9		10		12		14		ns	
Address setup time	^tAS	0		0		0		0		ns	
Address hold from end of write	^tAH	0		0		0		0		ns	
WRITE pulse width	$^tWP1$	9		10		12		14		ns	
WRITE pulse width	$^tWP2$	10		10		12		14		ns	
Data setup time	^tDS	6		8		10		10		ns	
Data hold time	^tDH	0		0		0		0		ns	
Write disable to output in Low-Z	^tLZWE	3		3		3		3		ns	7
Write Enable to output in High-Z	^tHZWE		6		6		8		8	ns	6, 7

AC TEST CONDITIONS

Input pulse levels	Vss to 3.0V
Input rise and fall times	3ns
Input timing reference levels	1.5V
Output reference levels	1.5V
Output load	See Figures 1 and 2

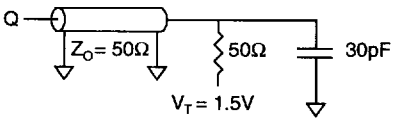


Fig. 1 OUTPUT LOAD EQUIVALENT

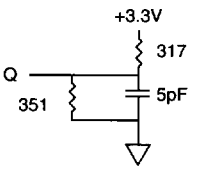


Fig. 2 OUTPUT LOAD EQUIVALENT

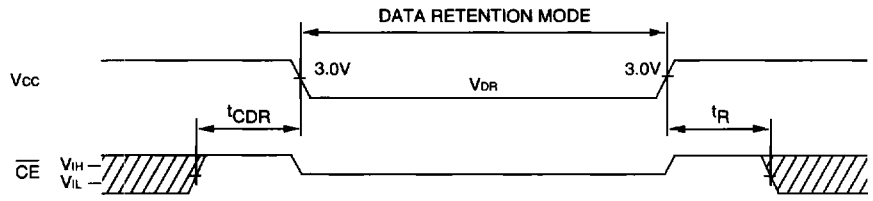
NOTES

1. All voltages referenced to Vss (GND).
2. Overshoot: $V_{IH} \leq +6.0V$ for $t \leq {}^tRC/2$
   Undershoot: $V_{IL} \geq -2.0V$ for $t \leq {}^tRC/2$
   Power-up: $V_{IH} \leq +6.0V$ and $V_{CC} \leq 3.1V$ for $t \leq 200msec$.
3. I_{CC} is dependent on output loading and cycle rates. The specified value applies with the outputs unloaded and $f = \frac{1}{{}^tRC\ (MIN)}$ Hz.
4. This parameter is sampled.
5. Test conditions as specified with the output loading as shown in Fig. 1 unless otherwise noted.
6. ${}^tHZCE$, ${}^tHZOE$ and ${}^tHZWE$ are specified with C_L = 5pF as in Fig. 2. Transition is measured ±200mV from steady state voltage.
7. At any given temperature and voltage condition, ${}^tHZCE$ is less than ${}^tLZCE$, and ${}^tHZWE$ is less than ${}^tLZWE$.
8. $\overline{WE}$ is HIGH for READ cycle.
9. Device is continuously selected. Chip enable and output enables are held in their active state.
10. Address valid prior to, or coincident with, latest occurring chip enable.
11. ${}^tRC$ = Read Cycle Time.
12. Chip enable and write enable can initiate and terminate a WRITE cycle.
13. The output will be in the High-Z state if output enable is high.
14. Typical currents are measured at 25°C.
15. Typical values are measured at 3.3V, 25°C and 15ns cycle time.

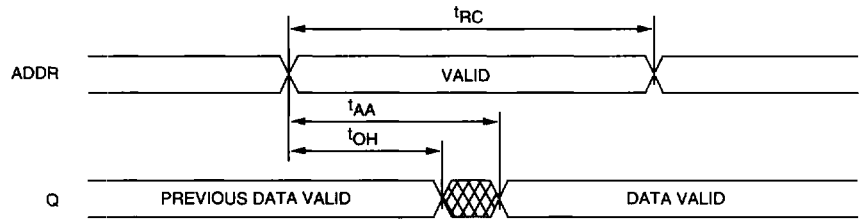
DATA RETENTION ELECTRICAL CHARACTERISTICS (L version only)

DESCRIPTION	CONDITIONS		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Vcc for Retention Data			V_{DR}	2			V	
Data Retention Current	$\overline{CE} \geq$ (Vcc -0.2V) $V_{IN} \geq$ (Vcc -0.2V) or ≤ 0.2V	Vcc = 2V	I_{CCDR}		70	300	µA	14
Chip Deselect to Data Retention Time			${}^tCDR$	0			ns	4
Operation Recovery Time			${}^tR$	${}^tRC$			ns	4, 11

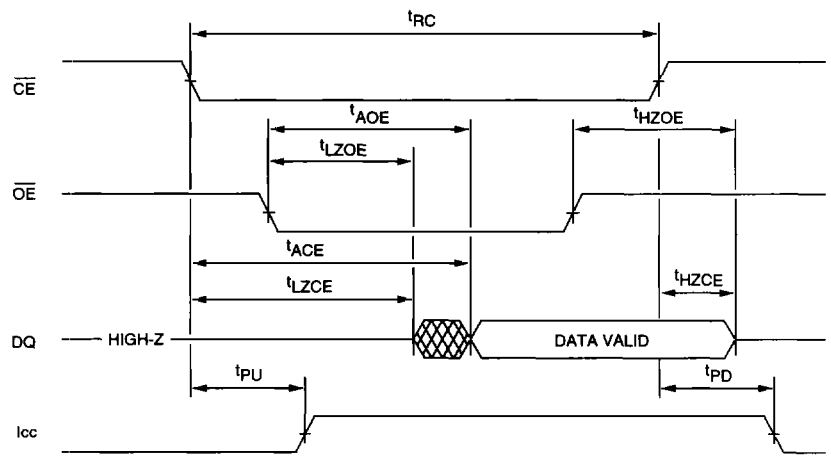
LOW Vcc DATA RETENTION WAVEFORM



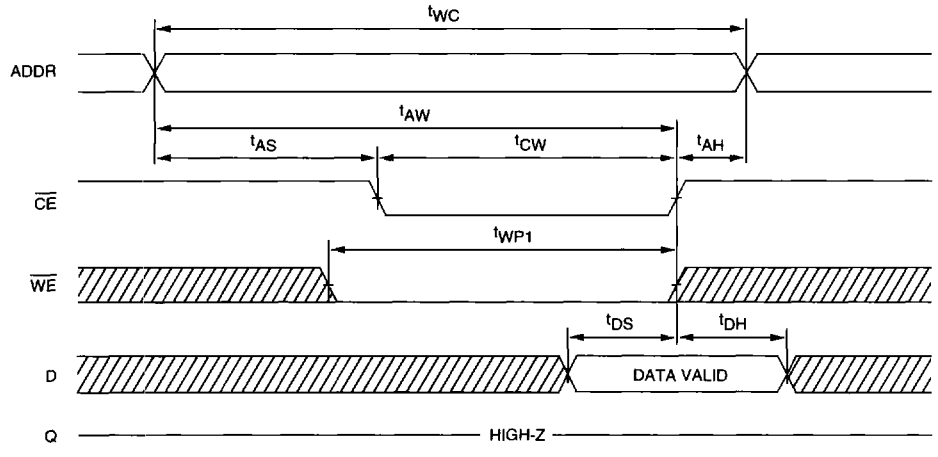
READ CYCLE NO. 1 [8, 9]



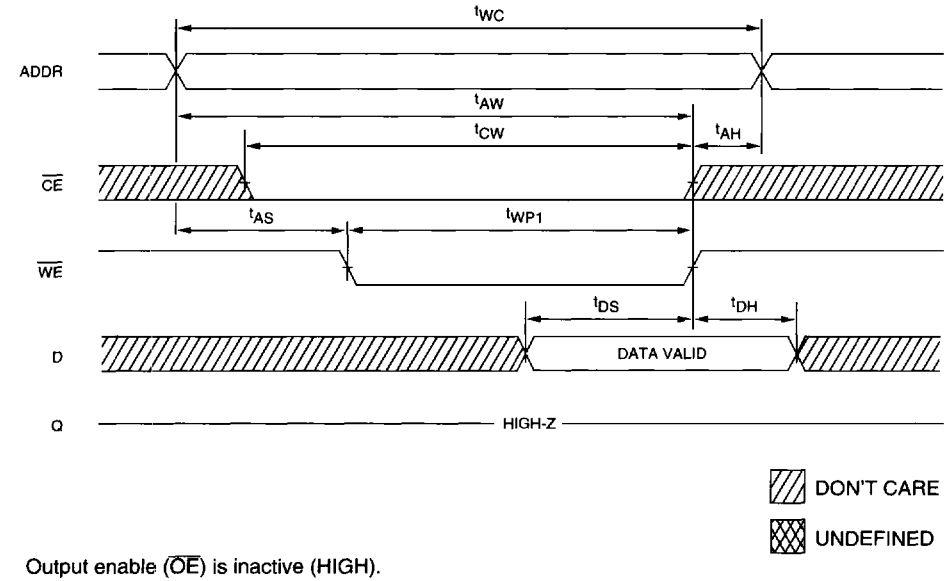
READ CYCLE NO. 2 [7, 8, 10]



WRITE CYCLE NO. 1 [12]
(Chip Enable Controlled)

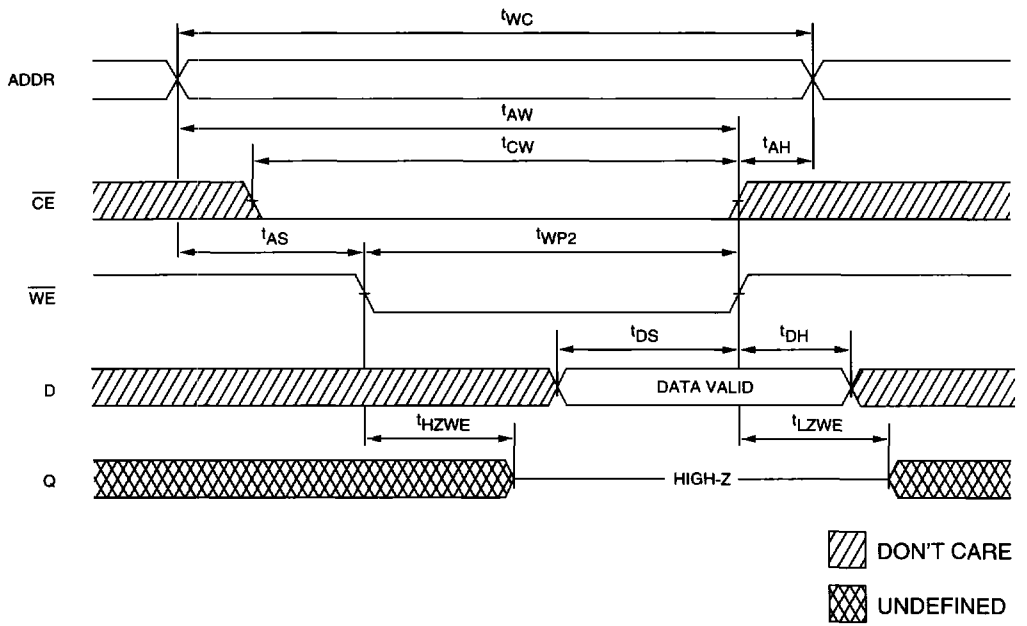


WRITE CYCLE NO. 2 [12]
(Write Enable Controlled)



NOTE: Output enable ($\overline{OE}$) is inactive (HIGH).

WRITE CYCLE NO. 3 [7, 12, 13]
(Write Enable Controlled)



NOTE: Output enable ($\overline{OE}$) is active (LOW).