

SRAM

256K x 4 SRAM

3.3V OPERATION WITH SINGLE CHIP
ENABLE, REVOLUTIONARY PINOUT

FEATURES

- All I/O pins are 5V tolerant
- High speed: 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 $\pm 0.3V$ power supply
- Fast \overline{OE} access times: 10 and 12ns
- Complies to JEDEC low-voltage TTL standards

OPTIONS

- Timing

15ns access	-15
20ns access	-20
25ns access	-25
- Packages

32-pin SOJ (400 mil)	DJ
32-pin TSOP (400 mil)	TG
- 2V data retention L
- Temperature

Commercial (0°C to +70°C)	None
Industrial (-40°C to +85°C)	IT
Automotive (-40°C to +125°C)	AT
Extended (-55°C to +125°C)	XT
- Part Number Example: MT5LC256K4D4DJ-20

NOTE: Not all combinations of operating temperature, speed, data retention and low power are necessarily available. Please contact the factory for availability of specific part number combinations.

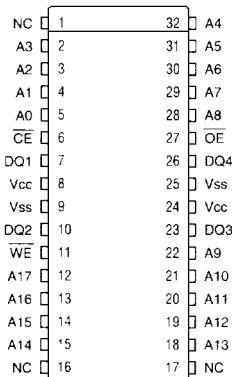
GENERAL DESCRIPTION

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.

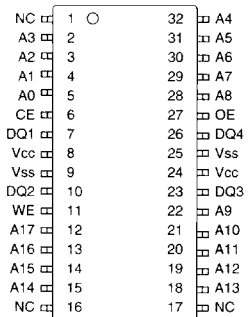
This device offers multiple center power and ground pins for improved performance. For flexibility in high-speed memory applications, Micron offers chip enable (\overline{CE}) and output enable (\overline{OE}) capability. This enhancement can place the outputs in High-Z for additional flexibility in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

PIN ASSIGNMENT (Top View)

32-Pin SOJ (SD-5)



32-Pin TSOP (SE-1)



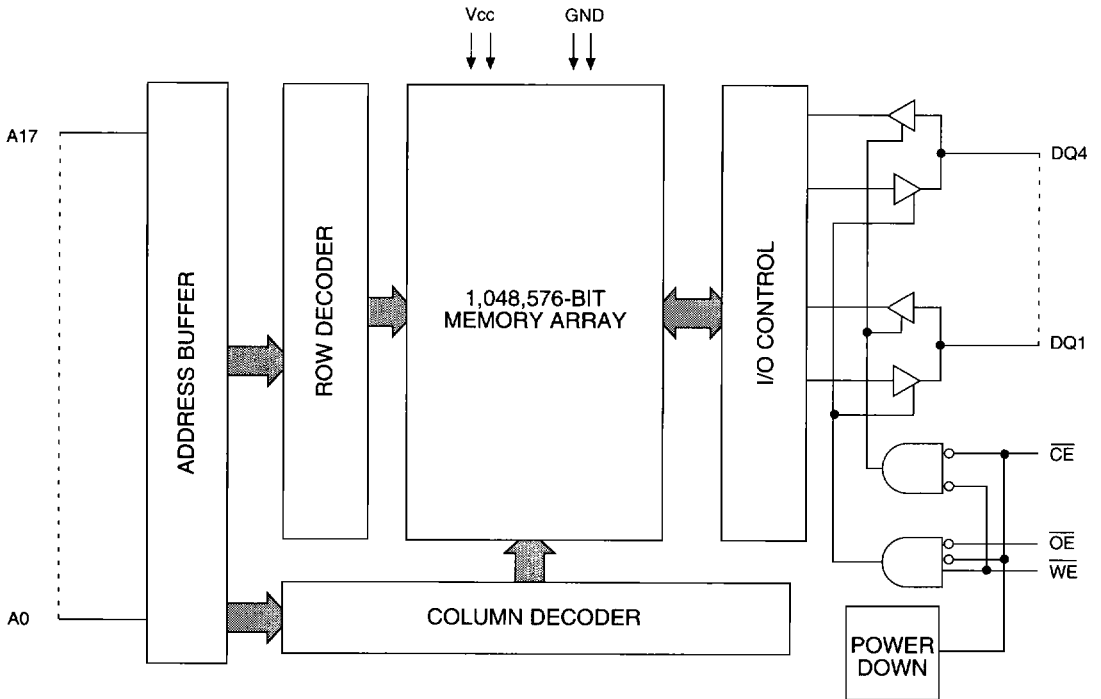
3.3 VOLT SRAM

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 and 5V tolerant. These low-voltage parts are ideal for mixed 3.3V and 5V systems.

FUNCTIONAL BLOCK DIAGRAM

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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	V _{CC}	Supply	Power Supply: 3.3V ±0.3V
9, 25	V _{SS}	Supply	Ground: GND
1, 16, 17	NC	-	No Connect: These signals are not internally connected.

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MICRON**MT5LC256K4D4
REVOLUTIONARY PINOUT 256K x 4 SRAM****ABSOLUTE MAXIMUM RATINGS***

Voltage on Vcc 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.

3.3 VOLT SRAM**ELECTRICAL CHARACTERISTICS AND RECOMMENDED DC OPERATING CONDITIONS**(0°C ≤ T_A ≤ 70°C; V_{cc} = 3.3V ± 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 ≤ V _{IN} ≤ V _{cc}	I _{LI}	-1	1	μA	
Output Leakage Current	Output(s) disabled 0V ≤ V _{out} ≤ 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

DESCRIPTION	CONDITIONS	SYMBOL	TYP	MAX			UNITS	NOTES
				-15	-20	-25		
Power Supply Current: Operating	$\overline{CE} \leq V_{IL}$; V _{cc} = MAX f = MAX = 1/1RC outputs open	I _{cc}	60	100	88	80	mA	3
Power Supply Current: Standby	$\overline{CE} \geq V_{IH}$; V _{cc} = MAX f = MAX = 1/1RC outputs open	I _{SB1}	10	20	16	14	mA	
	$\overline{CE} \geq V_{cc} - 0.2V$; V _{cc} = MAX V _{IN} ≤ V _{ss} + 0.2V or V _{IN} ≥ V _{cc} - 0.2V; f = 0	I _{SB2}	0.5	5	5	5	mA	

CAPACITANCE

DESCRIPTION	CONDITIONS	SYMBOL	MAX	UNITS	NOTES
Input Capacitance	T _A = 25°C; f = 1 MHz V _{cc} = 3.3V	C _i	6	pF	4
Output Capacitance		C _o	6	pF	4

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS(Note 5, 14) ($0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$; $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$)

DESCRIPTION	SYM	-15		-20		-25		UNITS	NOTES
		MIN	MAX	MIN	MAX	MIN	MAX		
READ Cycle									
READ cycle time	t_{RC}	15		20		25		ns	
Address access time	t_{AA}		15		20		25	ns	
Chip Enable access time	t_{ACE}		15		20		25	ns	
Output hold from address change	t_{OH}	4		5		5		ns	
Chip Enable to output in Low-Z	t_{LZCE}	5		5		5		ns	7
Chip disable to output in High-Z	t_{HZCE}		6		8		8	ns	6, 7
Chip Enable to power-up time	t_{PU}	0		0		0		ns	
Chip disable to power-down time	t_{PD}		15		20		25	ns	
Output Enable access time	t_{AOE}		8		10		12	ns	
Output Enable to output in Low-Z	t_{LZOE}	0		0		0		ns	
Output disable to output in High-Z	t_{HZOE}		6		8		8	ns	6
WRITE Cycle									
WRITE cycle time	t_{WC}	15		20		25		ns	
Chip Enable to end of write	t_{CW}	12		13		15		ns	
Address valid to end of write	t_{AW}	9		12		14		ns	
Address setup time	t_{AS}	0		0		0		ns	
Address hold from end of write	t_{AH}	0		0		0		ns	
WRITE pulse width	t_{WP1}	9		10		12		ns	
WRITE pulse width	t_{WP2}	9		10		12		ns	
Data setup time	t_{DS}	8		10		10		ns	
Data hold time	t_{DH}	0		0		0		ns	
Write disable to output in Low-Z	t_{LZWE}	1		1		1		ns	7
Write Enable to output in High-Z	t_{HZWE}		6		8		8	ns	6, 7

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AC TEST CONDITIONS

Input pulse levels	V _{SS} 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

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NOTES

- All voltages referenced to V_{SS} (GND).
- Overshoot: V_{IH} ≤ +6.0V for t ≤ ¹t_{RC}/2
 Undershoot: V_{IL} ≥ -2.0V for t ≤ ¹t_{RC}/2
 Power-up: V_{IH} ≤ +6.0V and V_{CC} ≤ 3.1V for t ≤ 200msec.
- I_{CC} is dependent on output loading and cycle rates. The specified value applies with the outputs unloaded, and $f = \frac{1}{{}^1t_{RC} \text{ (MIN)}}$ Hz.
- This parameter is sampled.
- Test conditions as specified with the output loading as shown in Fig. 1 unless otherwise noted.
- ¹t_{HZCE}, ¹t_{HZOE} and ¹t_{HZWE} are specified with CL = 5pF as in Fig. 2. Transition is measured ±200mV from steady state voltage.
- At any given temperature and voltage condition, ¹t_{HZCE} is less than ¹t_{LZCE}, and ¹t_{HZWE} is less than ¹t_{LZWE}.

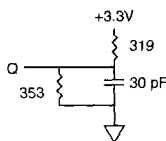


Fig. 1 OUTPUT LOAD EQUIVALENT

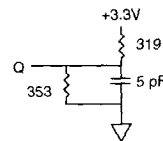


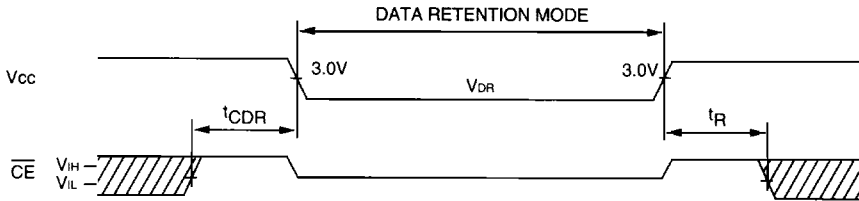
Fig. 2 OUTPUT LOAD EQUIVALENT

- \overline{WE} is HIGH for READ cycle.
- Device is continuously selected. Chip enable and output enables are held in their active state.
- Address valid prior to, or coincident with, latest occurring chip enable.
- ¹t_{RC} = Read Cycle Time.
- Chip enable and write enable can initiate and terminate a WRITE cycle.
- The output will be in the High-Z state if output enable is high.
- Contact Micron for IT/AT/XT timing and current specifications; they may differ from the commercial temperature range specifications shown in this data sheet.
- Typical currents are measured at 25°C.

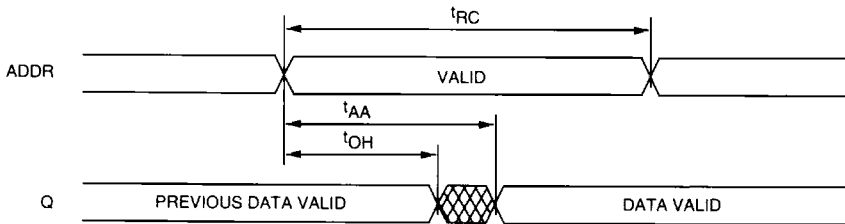
DATA RETENTION ELECTRICAL CHARACTERISTICS (L and LP versions only)

DESCRIPTION	CONDITIONS		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
V _{CC} for Retention Data			V _{DR}	2			V	
Data Retention Current L version LP version	$\overline{CE} \geq (V_{CC} - 0.2V)$ $V_{IN} \geq (V_{CC} - 0.2V)$ or ≤ 0.2V	V _{CC} = 2V	I _{CCDR}		TBD	TBD	μA	15
Chip Deselect to Data Retention Time			¹ t _{CDR}	0			ns	4
Operation Recovery Time			¹ t _R	¹ t _{RC}			ns	4, 11

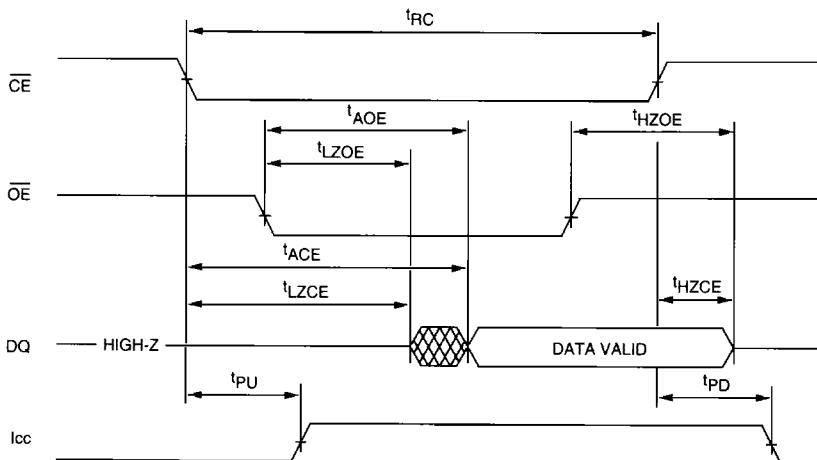
LOW V_{CC} DATA RETENTION WAVEFORM





READ CYCLE NO. 1 8, 9

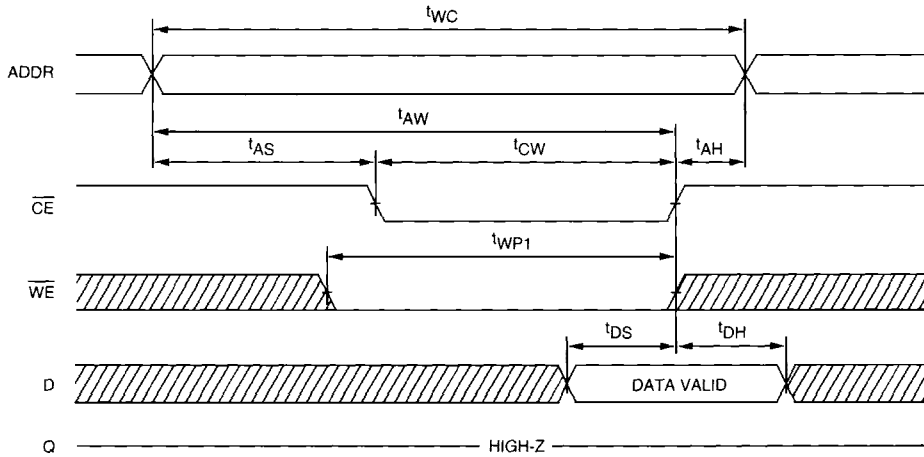


READ CYCLE NO. 2 7, 8, 10

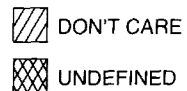
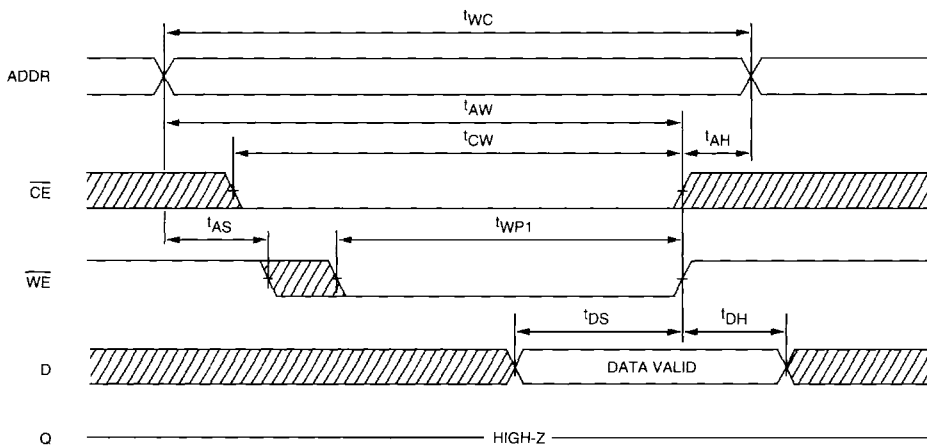


 DON'T CARE
 UNDEFINED

WRITE CYCLE NO. 1¹²
(Chip Enable Controlled)

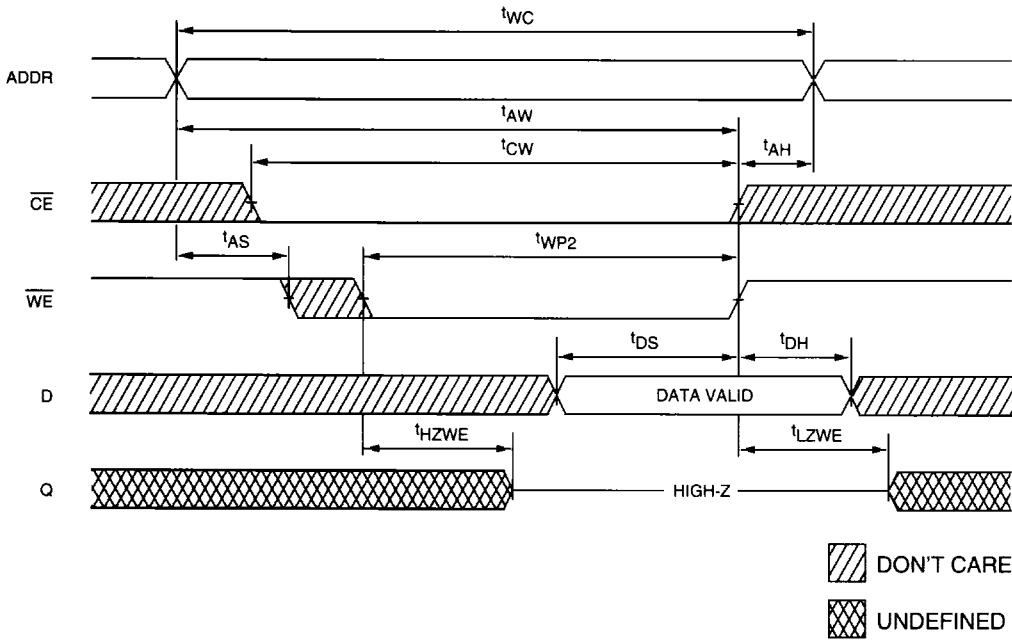


WRITE CYCLE NO. 2¹²
(Write Enable Controlled)



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

WRITE CYCLE NO. 3 ^{7, 12, 13}
 (Write Enable Controlled)



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

PRELIMINARY

MICRON
A HYUNDAI COMPANY

MT5LC256K4D4
REVOLUTIONARY PINOUT 256K x 4 SRAM

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