SRAM

16K x 4 SRAM
WITH OUTPUT ENABLE

FEATURES
- High speed: 8*, 10, 12, 15, 20 and 25ns
- High-performance, low-power, CMOS double-metal process
- Single +5V ±10% power supply
- Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ options
- All inputs and outputs are TTL compatible

OPTIONS — MARKING

- Timing

8ns access	- 8*
10ns access	-10
12ns access	-12
15ns access	-15
20ns access	-20
25ns access	-25

- Packages

Plastic DIP (300 mil)	None
Plastic SOJ (300 mil)	DJ

NOTE: Available in ceramic packages tested to meet military specifications. Please refer to Micron's *Military Data Book*.

- 2V data retention — L

- Temperature

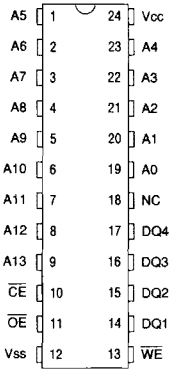
Industrial	(-40°C to +85°C)	IT
Automotive	(-40°C to +125°C)	AT
Extended	(-55°C to +125°C)	XT

- Part Number Example: MT5C6405DJ-15 L IT

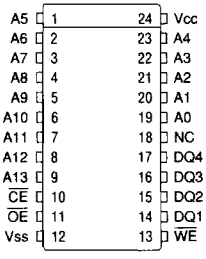
*Preliminary

PIN ASSIGNMENT (Top View)

24-Pin DIP
(SA-3)



24-Pin SOJ
(SD-1)



GENERAL DESCRIPTION

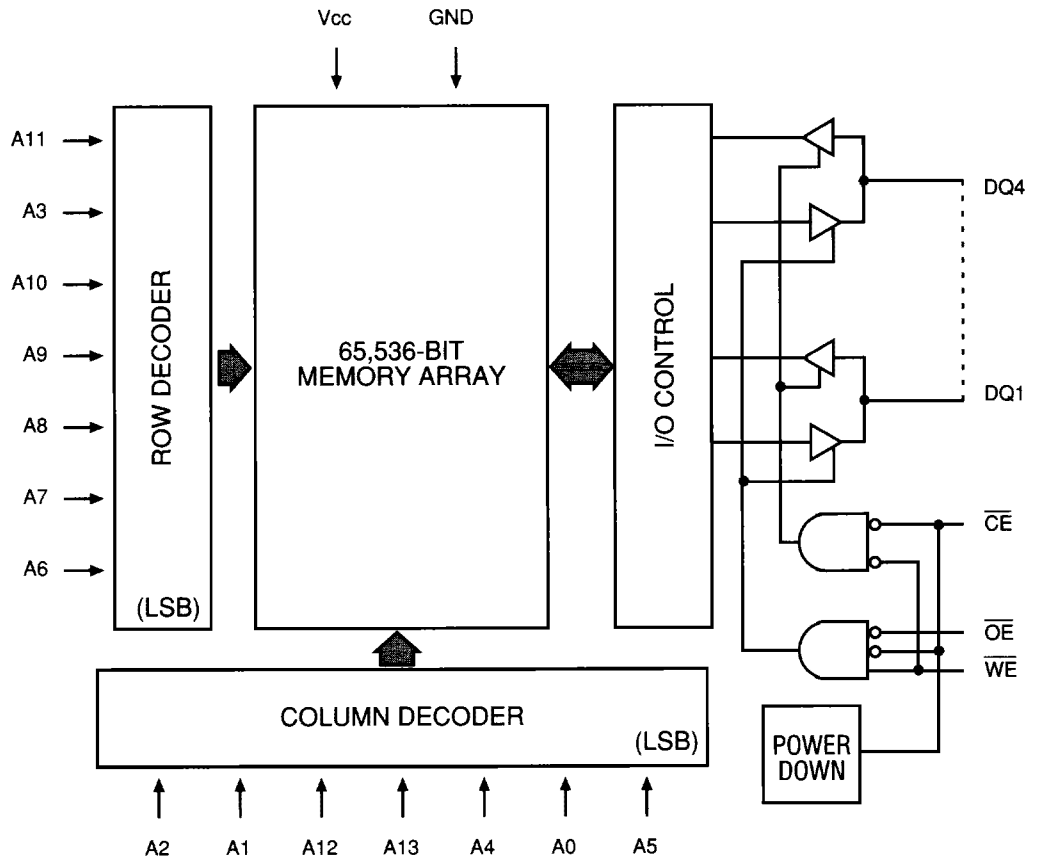
The Micron SRAM family employs high-speed, low-power CMOS designs using a four-transistor memory cell. Micron SRAMs are fabricated using double-layer metal, double-layer polysilicon technology.

For flexibility in high-speed memory applications, Micron offers chip enable ($\overline{CE}$) and output enable ($\overline{OE}$) with this organization. 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 and $\overline{OE}$ and $\overline{CE}$ go LOW. The device offers a reduced power standby mode when disabled. This allows system designers to meet low standby power requirements.

All devices operate from a single +5V power supply and all inputs and outputs are fully TTL compatible.

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
READ	H	L	H	HIGH-Z	ACTIVE
WRITE	X	L	L	D	ACTIVE

ABSOLUTE MAXIMUM RATINGS*

Voltage on V_{CC} Supply Relative to V_{SS} .....-1V to +7V
Storage Temperature (Plastic) .....-55°C to +150°C
Power Dissipation 1W
Short Circuit Output Current 50mA
Voltage on any pin relative to V_{SS} .....-1V to V_{CC} +1V

*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 ≤ T_A ≤ 70°C; V_{CC} = 5V ±10%)

DESCRIPTION	CONDITIONS	SYMBOL	MIN	MAX	UNITS	NOTES
Input High (Logic 1) Voltage		V_{IH}	2.2	V_{CC} +1	V	1
Input Low (Logic 0) Voltage		V_{IL}	-0.5	0.8	V	1, 2
Input Leakage Current	0V ≤ V_{IN} ≤ V_{CC}	I_{LI}	-5	5	µA	
Output Leakage Current	Output(s) Disabled 0V ≤ V_{OUT} ≤ V_{CC}	I_{LO}	-5	5	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}	4.5	5.5	V	1

				MAX							
DESCRIPTION	CONDITIONS	SYMBOL	TYP	-8+	-10	-12	-15	-20	-25	UNITS	NOTES
Power Supply Current: Operating	$\overline{CE}$ ≤ V_{IL}; V_{CC} = MAX f = MAX = 1/ ^tRC Outputs Open	I_{CC}	65	170	155	140	120	110	110	mA	3, 14
Power Supply Current: Standby	$\overline{CE}$ ≥ V_{IH}; V_{CC} = MAX f = MAX = 1/ ^tRC Outputs Open	I_{SB1}	20	60	50	45	40	35	35	mA	14
	$\overline{CE}$ ≥ V_{CC} -0.2V; V_{CC} = MAX V_{IN} ≤ V_{SS} +0.2V or V_{IN} ≥ V_{CC} -0.2V; f = 0	I_{SB2}	0.4	3	3	3	3	3	5	mA	14

+Preliminary

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} = 5V	C_O	7	pF	4

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

(Note 5, 13) (0°C ≤ T_A ≤ 70°C; Vcc = 5V ±10%)

DESCRIPTION		-8*		-10		-12		-15		-20		-25			
	SYM	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNITS	NOTES
READ Cycle															
READ cycle time	t_{RC}	8		10		12		15		20		25		ns	
Address access time	t_{AA}		8		10		12		15		20		25	ns	
Chip Enable access time	t_{ACE}		7		8		10		12		15		20	ns	
Output hold from address change	t_{OH}	3		3		3		3		3		3		ns	
Chip Enable to output in Low-Z	t_{LZCE}†	2		2		2		2		2		2		ns	7, 15
Chip disable to output in High-Z	t_{HZCE}		4		5		6		7		8		8	ns	6, 7
Chip Enable to power-up time	t_{PU}	0		0		0		0		0		0		ns	
Chip disable to power-down time	t_{PD}		8		10		12		15		20		25	ns	
Output Enable access time	t_{AOE}		3.5		4		5		6		7		8	ns	
Output Enable to output in Low-Z	t_{LZOE}	0		0		0		0		0		0		ns	
Output disable to output in High-Z	t_{HZOE}		3.5		4		5		6		7		8	ns	6
WRITE Cycle															
WRITE cycle time	t_{WC}	8		10		12		15		20		25		ns	
Chip Enable to end of write	t_{CW}	6.5		8		10		12		15		20		ns	
Address valid to end of write	t_{AW}	6.5		8		10		12		15		20		ns	
Address setup time	t_{AS}	0		0		0		0		0		0		ns	
Address hold from end of write	t_{AH}	0		0		0		0		0		0		ns	
WRITE pulse width	t_{WP1}	5.5		7		8		10		12		15		ns	
WRITE pulse width	t_{WP2}	8		9		10		14		18		20		ns	
Data setup time	t_{DS}	4.5		6		7		8		9		10		ns	
Data hold time	t_{DH}	0		0		0		0		0		0		ns	
Write disable to output in Low-Z	t_{LZWE}	2		2		2		2		2		2		ns	7
Write Enable to output in High-Z	t_{HZWE}		4		5		5		6		8		8	ns	6, 7

*These specifications are preliminary.

†The difference between the shaded and unshaded parameters is explained in note 15 on the following page.

AC TEST CONDITIONS

Input pulse levels	Vss to 3.0V
Input rise and fall times	5ns
Input timing reference levels	1.5V
Output reference levels	1.5V
Output load	See Figures 1 and 2

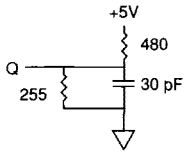


Fig. 1 OUTPUT LOAD EQUIVALENT

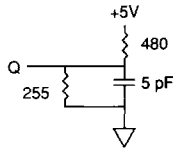


Fig. 2 OUTPUT LOAD EQUIVALENT

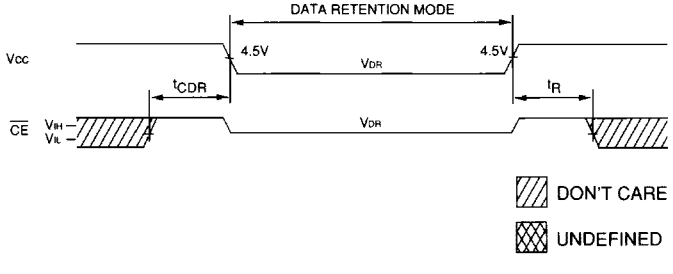
NOTES

1. All voltages referenced to Vss (GND).
2. -3V for pulse width < ^{t}RC/2.
3. Icc is dependent on output loading and cycle rates.
4. This parameter is sampled.
5. Test conditions as specified with the output loading as shown in Fig. 1 unless otherwise noted.
6. ^{t}HZCE, ^{t}HZWE and ^{t}HZOE are specified with CL = 5pF as in Fig. 2. Transition is measured ±500mV from steady state voltage.
7. At any given temperature and voltage condition, ^{t}HZCE is less than ^{t}LZCE and ^{t}HZWE is less than ^{t}LZWE.
8. $\overline{WE}$ is HIGH for READ cycle.
9. Device is continuously selected. All chip enables are held in their active state.
10. Address valid prior to, or coincident with, latest occurring chip enable.
11. ^{t}RC = Read Cycle Time.
12. Chip enable and write enable can initiate and terminate a WRITE cycle.
13. Refer to the IT/XT/AT section of Micron's *SRAM Data Book* for applicable non-commercial temperature range specifications.
14. Typical values are measured at 5V, 25°C and 20ns cycle time.
15. New designs should use the ^{t}LZCE parameters shown unshaded. The shaded ^{t}LZCE parameters represent screened parts, which are available upon request until January 1, 1994.

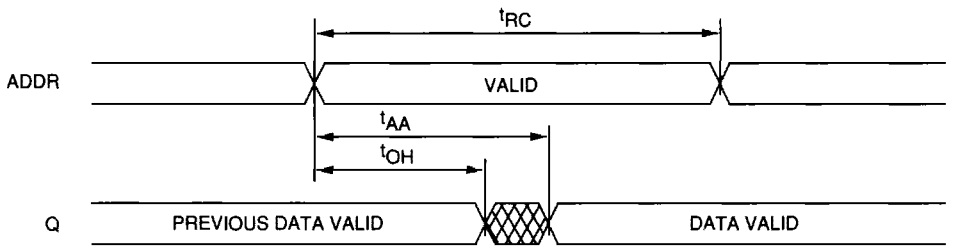
DATA RETENTION ELECTRICAL CHARACTERISTICS (L Version Only)

DESCRIPTION	CONDITIONS		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Vcc for Retention Data			V_{DR}	2			V	
Data Retention Current	$\overline{CE}$ ≥ (Vcc -0.2V) VIN ≥ (Vcc -0.2V) or ≤ 0.2V	Vcc = 2V	I_{CCDR}		95	250	µA	
		Vcc = 3V			125	400	µA	
Chip Deselect to Data Retention Time			^{t}CDR	0			ns	4
Operation Recovery Time			^{t}R	^{t}RC			ns	4, 11

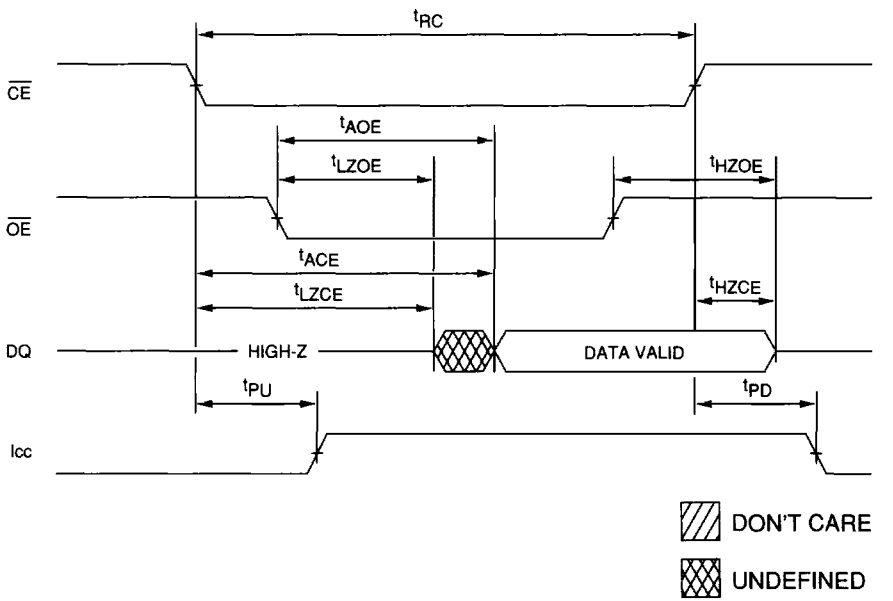
LOW Vcc DATA RETENTION WAVEFORM



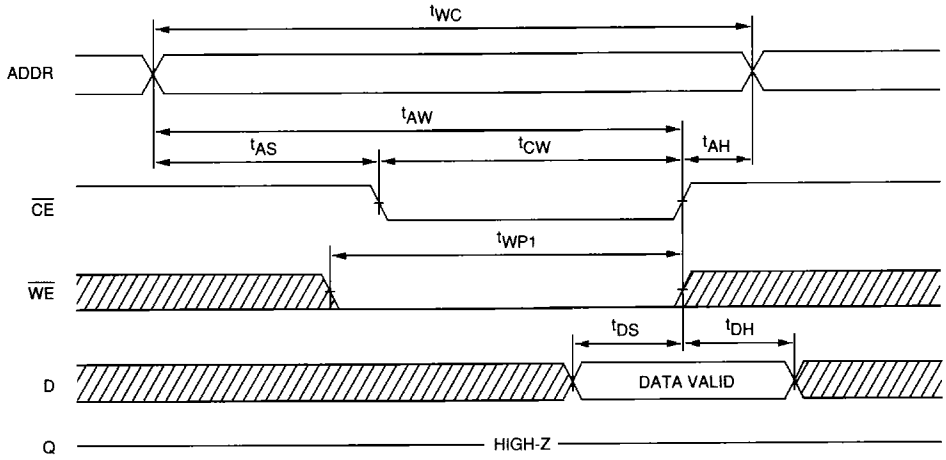
READ CYCLE NO. 1 [8, 9]



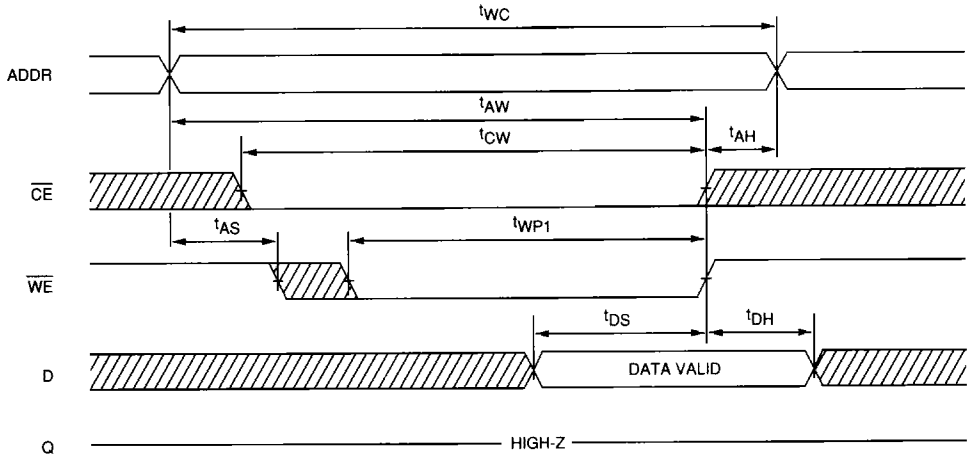
READ CYCLE NO. 2 [7, 8, 10]



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

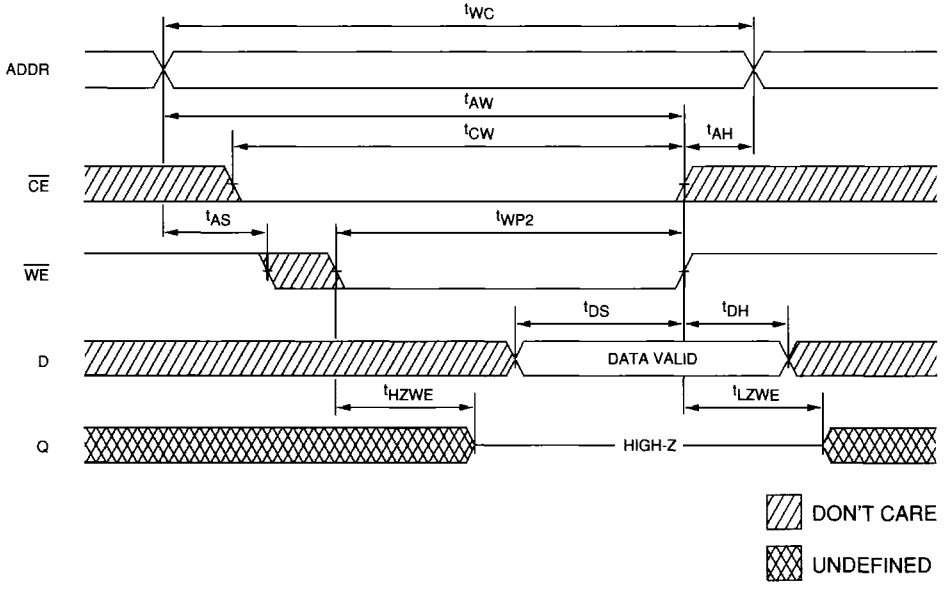


WRITE CYCLE NO. 2 [7, 12]
(Write Enable Controlled)



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

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



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