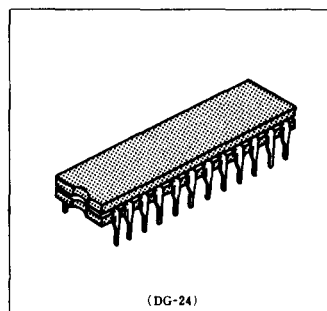


HM6116L-2, HM6116L-3, HM6116L-4

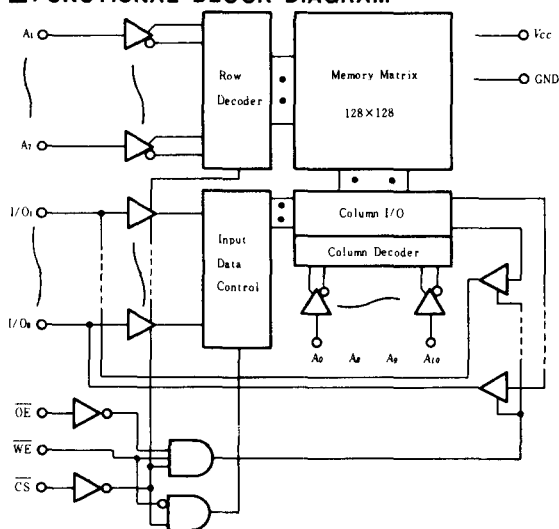
2048-word × 8-bit High Speed Static CMOS RAM

■ FEATURES

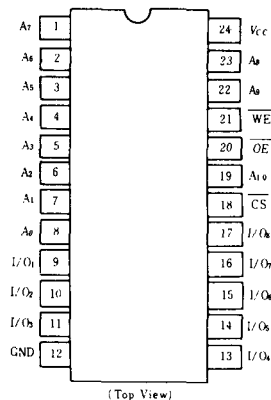
- Single 5V Supply and High Density 24 Pin Package
- High Speed: Fast Access Time 120ns/150ns/200ns (max.)
Low Power Standby and Standby: 20μW (typ.)
- Low Power Operation; Operation: 160mW (typ.)
- Completely Static RAM: No clock nor Timing Strobe Required
- Directly TTL Compatible: All Input and Output
- Pin Out Compatible with Standard 16K EPROM/MASK ROM
- Equal Access and Cycle Time
- Capability of Battery Back up Operation



■ FUNCTIONAL BLOCK DIAGRAM



■ PIN ARRANGEMENT



■ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Voltage on Any Pin Relative to GND	V_T	-0.5* to +7.0	V
Operating Temperature	T_{op}	0 to +70	°C
Storage Temperature	T_{stg}	-65 to +150	°C
Temperature Under Bias	T_{mb}	-10 to +85	°C
Power Dissipation	P_T	1.0	W

* Pulse Width 50ns : -3.5V

■ TRUTH TABLE

CS	OE	WE	Mode	V_{cc} Current	I/O Pin	Ref. Cycle
H	X	X	Not Selected	I_{sb}, I_{sb1}	High Z	
L	L	H	Read	I_{cc}	Dout	Read Cycle (1)~(3)
L	H	L	Write	I_{cc}	Din	Write Cycle (1)
L	L	L	Write	I_{cc}	Din	Write Cycle (2)

RECOMMENDED DC OPERATING CONDITIONS ($T_a=0$ to $+70^\circ\text{C}$)

Item	Symbol	min	typ	max	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
	GND	0	0	0	V
Input Voltage	V_{IH}	2.2	3.5	6.0	V
	V_{IL}	-3.0^*	—	0.8	V

* Pulse Width: 50ns, DC: V_{IL} min -0.3V

DC AND OPERATING CHARACTERISTICS ($V_{CC}=5\text{V} \pm 10\%$, GND=0V, $T_a=0$ to $+70^\circ\text{C}$)

Item	Symbol	Test Conditions	HM6116L-2			HM6116L-3/-4			Unit
			min	typ*	max	min	typ*	max	
Input Leakage Current	$ I_{LI} $	$V_{CC}=5.5\text{V}$, $V_{IN}=\text{GND to } V_{CC}$	—	—	2	—	—	2	μA
Output Leakage Current	$ I_{LO} $	$\overline{\text{CS}}=V_{IH}$ or $\text{OE}=V_{IH}$, $V_{ILO}=\text{GND to } V_{CC}$	—	—	2	—	—	2	μA
Operating Power Supply Current	I_{CC}	$\overline{\text{CS}}=V_{IL}$, $I_{ILO}=0\text{mA}$	—	35	70	—	30	60	mA
	I_{CC1}^{**}	$V_{IH}=3.5\text{V}$, $V_{IL}=0.6\text{V}$, $I_{ILO}=0\text{mA}$	—	30	—	—	25	—	mA
Average Operating Current	I_{CC1}	min. cycle, duty = 100%	—	35	70	—	30	60	mA
Standby Power Supply Current	I_{SB}	$\overline{\text{CS}}=V_{IH}$	—	4	12	—	4	12	mA
	I_{SB1}	$\text{CS} \geq V_{CC} - 0.2\text{V}$, $V_{IN} \geq V_{CC} - 0.2\text{V}$ or $V_{IN} \leq 0.2\text{V}$	—	4	100	—	4	100	μA
Output Voltage	V_{OL}	$I_{OL}=4\text{mA}$	—	—	0.4	—	—	—	V
		$I_{OL}=2.1\text{mA}$	—	—	—	—	—	0.4	
	V_{OH}	$I_{OH}=-1.0\text{mA}$	2.4	—	—	2.4	—	—	V

* : $V_{CC}=5\text{V}$, $T_a=25^\circ\text{C}$

** : Reference Only

AC CHARACTERISTICS ($V_{CC}=5\text{V} \pm 10\%$, $T_a=0$ to $+70^\circ\text{C}$)

AC TEST CONDITIONS

Input Pulse Levels: 0.8 to 2.4V

Input Rise and Fall Times: 10 ns

Input and Output Timing Reference Levels: 1.5V

Output Load: 1TTL Gate and $C_L = 100\text{pF}$ (including scope and jig)

READ CYCLE

Item	Symbol	HM6116L-2		HM6116L-3		HM6116L-4		Unit
		min	max	min	max	min	max	
Read Cycle Time	t_{RC}	120	—	150	—	200	—	ns
Address Access Time	t_{AA}	—	120	—	150	—	200	ns
Chip Select Access Time	t_{ACS}	—	120	—	150	—	200	ns
Chip Selection to Output in Low Z	t_{CLZ}	10	—	15	—	15	—	ns
Output Enable to Output Valid	t_{OE}	—	80	—	100	—	120	ns
Output Enable to Output in Low Z	t_{OLZ}	10	—	15	—	15	—	ns
Chip deselection to Output in High Z	t_{CHZ}	0	40	0	50	0	60	ns
Chip Disable to Output in High Z	t_{CHZ}	0	40	0	50	0	60	ns
Output Hold from Address Change	t_{OH}	10	—	15	—	15	—	ns

● WRITE CYCLE

Item	Symbol	HM6116L-2		HM6116L-3		HM6116L-4		Unit
		min	max	min	max	min	max	
Write Cycle Time	t_{WC}	120	—	150	—	200	—	ns
Chip Selection to End of Write	t_{CW}	70	—	90	—	120	—	ns
Address Valid to End of Write	t_{AW}	105	—	120	—	140	—	ns
Address Set Up Time	t_{AS}	20	—	20	—	20	—	ns
Write Pulse Width	t_{WP}	70	—	90	—	120	—	ns
Write Recovery Time	t_{WR}	5	—	10	—	10	—	ns
Output Disable to Output in High Z	t_{OHZ}	0	40	0	50	0	60	ns
Write to Output in High Z	t_{WNZ}	0	50	0	60	0	60	ns
Data to Write Time Overlap	t_{DWO}	35	—	40	—	60	—	ns
Data Hold from Write Time	t_{DH}	5	—	10	—	10	—	ns
Output Active from End of Write	t_{OW}	5	—	10	—	10	—	ns

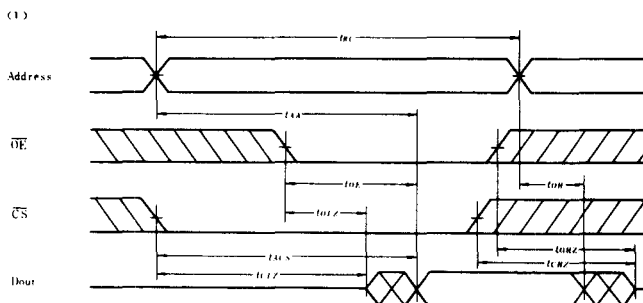
■ CAPACITANCE ($f=1\text{MHz}$, $T_a=25^\circ\text{C}$)

Item	Symbol	Test Conditions	typ	max	Unit
Input Capacitance	C_{in}	$V_{in}=0\text{V}$	3	5	pF
Input/Output Capacitance	$C_{i/o}$	$V_{i/o}=0\text{V}$	5	7	pF

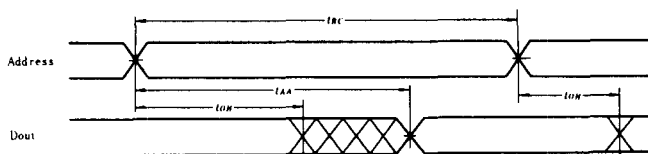
Note) This parameter is sampled and not 100% tested.

■ TIMING WAVEFORM

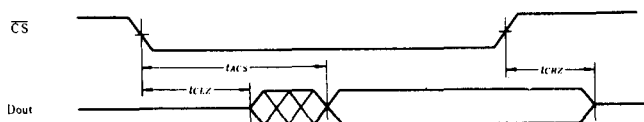
● Read Cycle (1)



● Read Cycle (2)

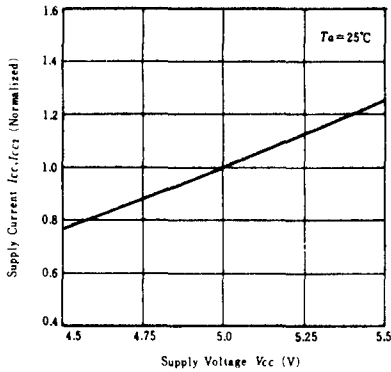


● Read Cycle (3)

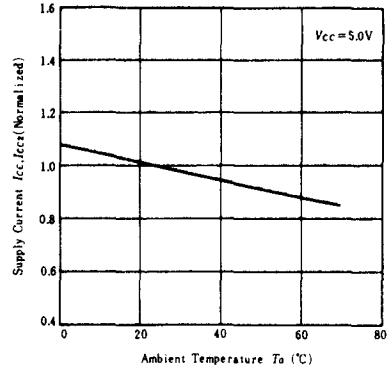


- NOTES: 1. $\overline{WE}$ is High for Read Cycle.
 2. Device is continuously selected, $\overline{CS} = V_{IL}$.
 3. Address Valid prior to or coincident with $\overline{CS}$ transition Low.
 4. $\overline{OE} = V_{IL}$.

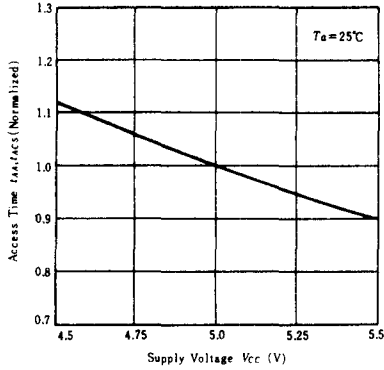
**SUPPLY CURRENT vs.
SUPPLY VOLTAGE**



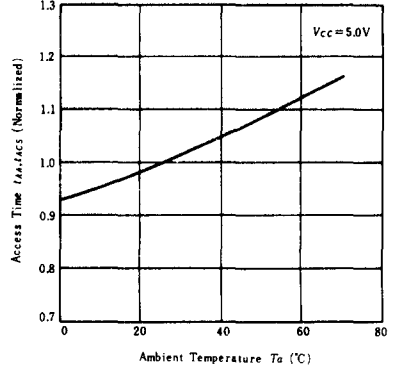
**SUPPLY CURRENT vs.
AMBIENT TEMPERATURE**



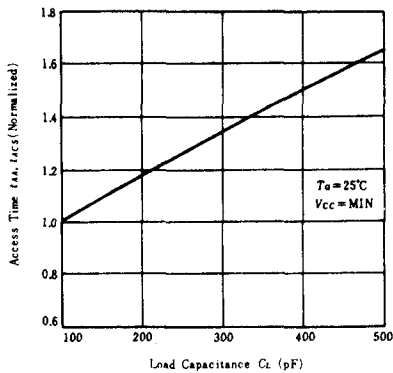
**ACCESS TIME vs.
SUPPLY VOLTAGE**



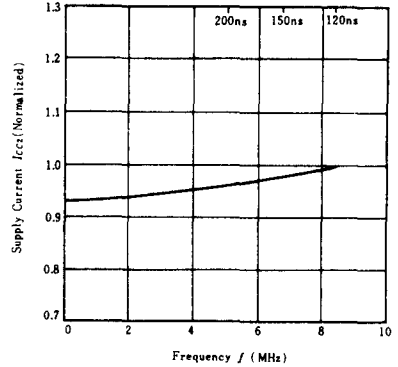
**ACCESS TIME vs.
AMBIENT TEMPERATURE**

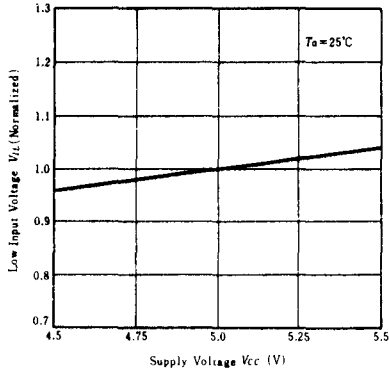
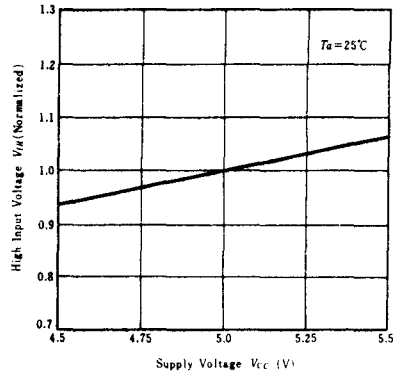
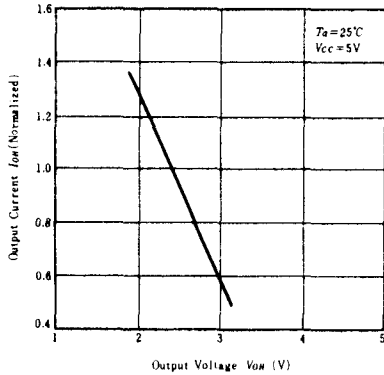
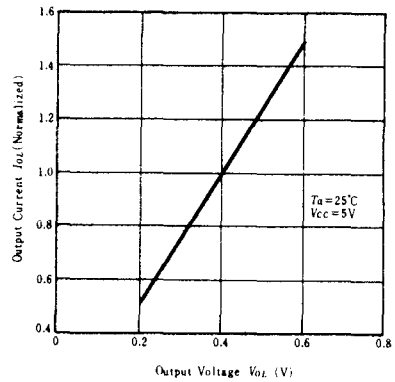
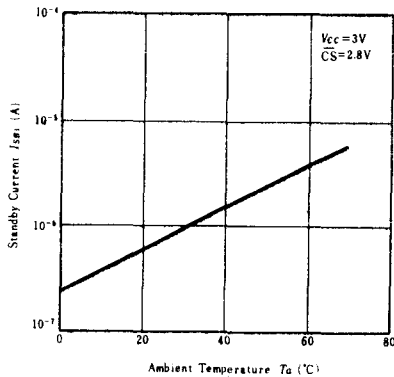
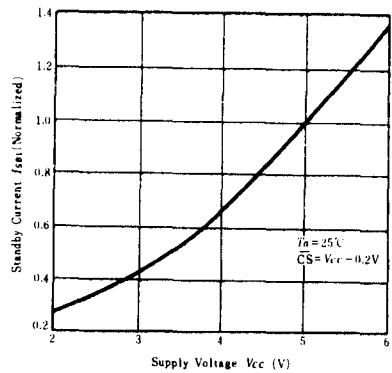


**ACCESS TIME vs.
LOAD CAPACITANCE**



**SUPPLY CURRENT vs.
FREQUENCY**



**LOW INPUT VOLTAGE vs.
SUPPLY VOLTAGE****HIGH INPUT VOLTAGE vs.
SUPPLY VOLTAGE****OUTPUT CURRENT vs.
OUTPUT VOLTAGE****OUTPUT CURRENT vs.
OUTPUT VOLTAGE****STANDBY CURRENT vs.
AMBIENT TEMPERATURE****STANDBY CURRENT vs.
SUPPLY VOLTAGE**

**STANDBY CURRENT vs.
INPUT VOLTAGE**

